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A Weekly Review of Current Progress in Electricity and its Practical Applications

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CONTENTS.

	Page.
ILLUSTRATED ARTICLES:	
Silvered Incandescent Lamp for Reflecting Purposes	24
The Heinrichs System of Arc Lighting	25
Static Electricity	26
Battery for Domestic Electric Lighting	27
A New Torpedo Boat Steered by Electricity	27
Application of Electricity to Propulsion of Elevated Railroads	27
How to Wind the Magnets for Shunt Series and Compound Machines	28
The Condenser in Telegraphy	29
A Small Electric Motor	29
EDITORIAL PARAGRAPHS	23
MISCELLANEOUS:	
Ten New Electric Light Companies	24
Electrical Steering Gear	24
Wide-Awake Chicago Messengers	24
New Carbon Filaments	24
The Interdependence of Nature	24
The Cost of Gas in America	24
Incandescent Lamp Tests by the Franklin Institute	25
MISCELLANEOUS:	
The Demand for Underground Wires in England	25
Edison at Work	26
The Lowell Telephone Syndicate Pays $32,000	26
Our Patent System and its Defects	26
Mechanical Telephones	27
Mr. Stokes Objectionable	29
REVIEWS OF NEW BOOKS:	
The Mathematical Theory of Electricity and Magnetism	24
Dynamo-Electric Machinery	24
Annuaire du Bureau des Longitudes pour 1886	24
DEPARTMENTS:	
New York Notes	30
New England Notes	30
Philadelphia Notes	30
Western Notes	30
The Telegraph	31
The Telephone	31
The Electric Light	31
Applications of Power	31
Personal	31
Miscellaneous Notes	31
Sparks and Flashes	31
Stock Quotations	31
Business Notices	31
Our Illustrated Record of Electrical Patents	32

New Advertisements.

	Page.
The Leclanché Battery Co.—Gonda and Disque Batteries	ii
Rice, Whitacre & Co.—Engines	iii
Redding Electrical Company—Annunciators	iii
The Cleverly Electrical Works—Electric Light and Gas Lighting Apparatus, etc	iii
Positions Wanted	32
Henry Carey Baird & Co.—"Wahl's Galvanoplastic Manipulations"	32
George W. Lord—Prevention of Boiler Scaling and Corrosion	v
Chemical Electric Light and Power Co.—"Volta Favia," a New Battery Solution	v
Pond Engineering Co.—Engineers and Contractors for Electric Light Plants	vi

Vol. VII. NEW YORK, JANUARY 16, 1886. No. 3.

THE table given in this issue showing the prices of gas in various large cities and different parts of the country will be found very interesting by all engaged in electric lighting. It is always well to know the numerical force of the "enemy" and the strength of his entrenchments.

APROPOS of nomenclature and definitions we note that several of our transatlantic contemporaries have entered into a discussion of the definition of "primary" and "secondary" battery. While there can be little room for ambiguity in regard to their practical application, the terms might as well be definitely adjudicated upon.

WITH the newly adopted rate of twelve words for twelve cents, addresses included, the English postal telegraphs appear to be doing very fairly. The government wires in England are now transmitting one million words of press matter every day—365,000,000 words a year, as compared with more than 1,000,000,000 words in the United States. The service is now operating about 156,000 miles of wire.

OUR Philadelphia correspondent gives a lively idea in his bright letter this week of the unpleasant dilemma in which the unfortunate citizens there find themselves. They did not want any overhead wires, and now, in mid winter, just ahead of spring thaws and mud, a number of the companies are about to tear up the streets in every direction—not for the joke of the thing, but in sober earnest, as if to shame the city that passed an underground ordinance but cannot bury its own wires.

WE note with regret the death of Mr. Alfred Tribe at the age of forty-six. This eminent chemist had devoted his energies particularly to the study of the storage battery, and in connection with Dr. Gladstone had done much good work. His knowledge as a chemist eminently fitted him for this line of study, for it cannot be denied that the action of the storage battery is peculiarly a chemical one, and that we must look to the chemist, in connection with the electrician, to give us the successful storer.

THE American Electric Manufacturing Company evidently means business. It now announces the formation of ten new electric-lighting sub-companies, with strong directorates, and is said to have a score more companies about ready to organize. We are very glad to see this push. There is practically no limit to the electric lighting business. Wherever gas has been used, a field exists for the electric light. Ample elbow room and plenty of patronage can be found by companies under brainy and energetic management and operating a good, trustworthy system.

PROFESSOR HUXLEY'S remarks on the interdependence of nature, quoted by us in another column, bring out forcibly the wide application which electricity and magnetism have found in scientific investigation as well as in our daily environments. It is, indeed, significant that he should single out electricity as *the* example of this interdependence. The few points that he mentions might be increased one hundred fold even now, and as he says truthfully, "the vast application of scientific knowledge has created a growing demand for technical education, based upon science." We might add that electrical technical education is in great demand just at present, and that it must inevitably secure more recognition than is now accorded to it.

THE incongruity, not to say chaos, which has long existed in electrical nomenclature and which has been increased particularly during the past few years, has been the subject of frequent comment by us, but up to the present time no steps have been taken looking to a remedy. It is gratifying, therefore, to note that the Society of Telegraph Engineers and Electricians has set itself to work to institute a uniform system of electrical nomenclature, with the help of English professors and French electricians. This is a move in the right direction, and if we may be allowed to make a suggestion it would be, to add to those above mentioned the names of a few on this side of the water. Surely, with our large electrical interests, we ought to have a voice in the application and definition of terms, and the home of the telegraph and telephone ought to be recognized in this matter.

THE full report of the English lighthouse tests is now at hand, and while its general results have already been noticed by us, we must draw attention to an important fact brought out by them, suggesting the adaptability of the incandescent lamp for lighthouse purposes. It was shown that the distance at which a light is seen in a fog depends upon the intrinsic brightness of the flame, and that an increase in the size adds very little to the penetrative power. Thus the glowing filament of a 50 candle-power incandescent lamp gave a stronger illumination than a larger 100 candle-power lamp, and more than two-thirds of the illumination from a 108-jet gas light behind the same lens. This experiment raises the interesting question whether the grouping of incandescent lamps within the compass of a sphere six inches in diameter will not give a very effective lighthouse light.

THE time for holding the meeting of the National Electric Light Association at Baltimore draws near, and there is every promise that the occasion will be one of great interest and profit to all who participate. We trust that all our electric light readers who are in any way concerned will set about making their arrangements to be present, and if they have not yet obtained membership in the Association to join at once. The dues are small and are offset by the information picked up at a single morning session. Aside from the serious business of such meetings, is the pleasure that comes from seeing old friends again and from forming new acquaintances; and Baltimore ought just now to be specially attractive to all engaged in operating dynamos, from the fact that it has to-day a practical electric railway in full working order. As nearly all our electric-light stations are soon to supply power for their neighborhoods, a great opportunity to look into the matter is here presented that should unhesitatingly be availed of.

NEXT to perpetual motion, though not on the same level with it, comes the problem of obtaining power direct from solar energy as one that has long occupied the minds of inventors. Indeed men of no mean order of talent have devoted themselves to the construction of apparatus for the latter purpose, the celebrated Ericsson being among them. The enormous heat energy radiated upon the earth, if converted into useful work, would meet all demands of power, but the great obstacle to its utilization lies in its diffused form. It would require considerable surface to concentrate upon a boiler enough heat to convert water into steam which could be used in an engine even of small power, and the use of other liquids beside water offers no remedy to the objection. Recently, however, the method of converting solar energy into electrical and mechanical work has been devised, in which the action of the sun generates an electric current in the selenium cell. This method is still in its infancy, but great things are hoped for it. If the roofs of our houses could be made to gather energy which could be utilized within the house, we would have, free of cost, most of the conveniences of modern civilization, for which *power* is required. The problem is well worth studying.

IT is most unfortunate that the authenticity of the Franklin Institute electrical tests should again be called in question, and this time by a leading English firm. While there may have been nothing wrong in the manner of procurement of some of the Woodhouse & Rawson lamps, it cannot be denied that the occurrence as represented by the manufacturers is open to criticism. It would have been better to have obtained the lamps entirely from disinterested parties or direct from the makers. The Institute appears to have acted in the sincere belief that it could test any lamps it chose to put on trial in this way, but it must be obvious that in expensive operations of this nature it is best to avoid any possible criticism or suspicion, and that injury may be done by taking lamps for whose efficiency at the time of sale the makers are not prepared to assume responsibility. In calling attention, as requested, to the complaint of Messrs. Woodhouse & Rawson, we cannot but deplore the fact that so much dissatisfaction should have resulted from the tests. It is true that these tests never are satisfactory, but we would have liked our English friends to feel that there was perfect fairness in the methods adopted by an authority so highly esteemed throughout America as the Franklin Institute.

THE applicability of electricity as a motive power for elevated railways is well demonstrated by Mr. F. J. Sprague, whose paper on this subject we begin with this issue. We call special attention to this article, as the problem is here attacked in a scientific manner and from the standpoint of the engineer. The main question to be solved here in New York is not, how can the expenses be reduced; but how can the carrying capacity be increased? It is not asked that the employment of electricity shall greatly reduce the cost of operating the roads, but if with electricity a train of six cars or more can be run with as great facility and speed as four, the present limit, then evidently the earning capacity of the roads must increase. That the utmost capacity of the roads has now been reached with steam is conceded, and a remedy must be applied. Mr. Sprague intends to solve the problem by providing each car with its own motor, so that as regards the question of tractive power the train might be of unlimited length. He argues truly, also, that the length of time required to bring the train to speed will be no greater with six cars than with one, so that transit will be faster and more trains can be put on the road. He shows also that considerable power will be saved and even returned by the motors when running down grade, and that they will serve as excellent brakes. Work on Mr. Sprague's system is being actively pushed, and we may soon expect a trial of it in this city.

IT has for a long time been the prevailing impression that only the impatient American would swear through the telephone. That idea is now exploded, as a Belgian musician has got himself into hot water by his profanity heard over the wire. The palace of the Queen of Belgium, situated at Laeken, is connected by telephone with the Opera-house in Brussels, and it appears that her Majesty was the other day amusing herself by listening through the telephone to a rehearsal of the new opera by Litolff, when she suddenly dropped the receiver and retired. The leader of the orchestra, in his anxiety to bring the chorus up to the degree of perfection he considered necessary, used rather strong language, forgetting for the moment that the telephone was present, and his words reached the royal ears. The Queen made a formal complaint, and now there is much trouble at the Opera-house. Nobody dares speak above a whisper, for fear of giving offense, and things look very gloomy. We say: serves the Queen right. Any person who eavesdrops on another ought to bear the consequences, and not complain of what he, or she, hears. Anyhow, this way of playing the "dead-head" trick on an unsuspecting manager, struggling with a raw company, deserves condemnation, and the incident will no doubt have a salutary effect on the Queen (and on the musician also, we hope). Her majesty will now, like Marie Antoinette, have some idea of the labor and worry involved in getting a piece ready for the stage.

REVIEWS OF NEW BOOKS.

THE MATHEMATICAL THEORY OF ELECTRICITY AND MAGNETISM. By H. W. Watson and S. H. Burbury. Vol. I., Electrostatics: MacMillan & Co. Price, $2.75.

Maxwell's eminent work is written from the standpoint of the physicist, mathematics being employed merely as an aid to the elucidation of Professor Maxwell's theories. The present volume may be considered a running commentary on the former, and as one in which the mathematical part is fully elaborated. For those of a mathematical turn of mind the book will prove of great value, especially when read in connec ion with Maxwell.

DYNAMO-ELECTRIC MACHINERY; A MANUAL FOR STUDENTS OF ELECTROTECHNICS. By Silvanus P. Thompson. *Second edition*, 1886, pp. 527. New York, E. & F. N. Spon. Price, $5.

Those who had the good fortune to procure an early copy of the first edition of Professor Thompson's admirable work had good reason to congratulate themselves on their acquisition, as the last few months have witnessed a decided demand for, without the means of supply of, the book. This great demand was a natural consequence, when we consider the character of the work. Before its appearance the dynamo and its theory of construction had been treated in a fragmentary, independent manner, which the student naturally found unavailable for his particular wants, and hence Professor Thompson's work, in which the subject is treated in a systematic and connected manner, was a great *desideratum*.

Excellent as the first edition was, the one before us is a decided improvement. Many things which were briefly touched upon in the first are here elaborated, and a great deal of new matter has been put in. It would lead us too far to note in detail all the changes and additions which have been made in the new edition, but we may state that two new chapters have been introduced; one on machines for electro-plating and electro-metallurgy, and one on the coupling of two or more dynamos in one circuit.

The number of illustrations has also been greatly increased, assisting greatly in the elucidation of the text. Taken altogether, the former work has been carefully revised, and we note the correction of several errors, so that the present volume is almost without a blemish. Every one should have this second edition.

The volume is well printed in large type, and sustains the high reputation of Professor Thompson as a clear writer.

ANNUAIRE DU BUREAU DES LONGITUDES POUR 1886, avec des notices scientifiques. Paris: Gauthier Villars.

This nautical almanac contains a large amount of information in addition to the purely astronomical, among other matters, a considerable treatise on the origin and action of tornadoes.

Ten New Electric Light Companies.

The development of the new system of electric lighting owned by the American Illuminating Company is becoming very marked. On Saturday last papers were filed in this city and at Albany for the incorporation of no less than ten companies to operate the "American" (Wood) system of electric lighting. Each company will be known as "The American Illuminating Company of ——" adding the name of the town where it operates. They will be located as follows: In New York City, Brooklyn, Harlem, Yonkers, Long Island City, Newburg, Cohoes, Syracuse, Watertown and Ogdensburg. The New York company will have a capital of $300,000 and the Brooklyn and Harlem companies $100,000. The capital of the remaining seven is fixed at $30,000 each. The incorporators and trustees of these companies are: Hon. L. M. Bates, Col. F. K. Hain, Senator John J. Kiernan, Samuel H. Willard, Henry C. Adams, Edward H. Goff and A. B. Chandler, all of New York; H. S. Hyde, of Springfield, Mass., and H. P. Frost, of New Haven, Conn.

Electrical Steering Gear.

The U. S. Ship "Tallapoosa" was put in commission this week, and will shortly make a trip for the purpose of testing Mr. Chas. K. Washburn's electrical steering gear, which has already been described in these columns. The electrical appliances, which were installed by the United States Electrical Company, of this city, were found to be in perfect order, and the trial at the dock proved successful throughout. It remains now only to test the apparatus at sea, which will shortly be done.

Wide-Awake Chicago Messengers.

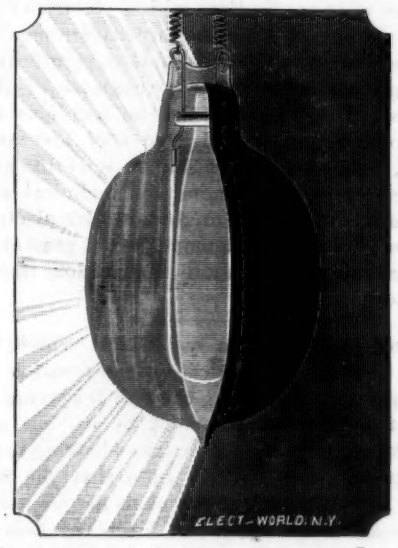
It has been the custom of a hotel in Chicago to present all telegraph and district messengers with a cash gift of fifty cents on Christmas. This year the youngsters inaugurated a game worthy of the intellect of Jay Gould. Gathering together all their companions who were not messengers, they traded certificates and official uniforms—the transfers taking place in convenient alleys—in such a way that a constant stream of apparent messengers was maintained. The cashier cashed every certificate that was presented, and doubtless would have disbursed to the end of the "run" or "busted" the vaults, had it not been for the chance appearance on the outside of the counter of one of the proprietors, who was startled by the panicky look of things. He ordered the cashier to suspend payment pending an investigation. A little detective work exposed the whole plan. The financial managers of the raid were found in an alley. Fresh recruits were arriving from the juvenile colonies in the Blue Island District. When the young scamps were detected and dispersed the cashier resumed payment on doubly indorsed certificates.

New Carbon Filaments

A chemical process for making carbon filaments for incandescent lamps is described by Mr. A. Smith in *Dingler's Polytechnisches, J.* 257, 338. Hydrogen chloride is passed through furfuraldehyde or fucusaldehyde, and a black liquid is obtained which is placed between two glass plates. From this liquid a thin layer of carbon separates after eight or ten hours, and the thickness of the layer is regulated by inserting wires between the plates. This layer is removed, cut into strips, and twisted, and heated to 100 degrees Cent. Afterwards these filaments are heated in closed crucibles, through which a current of marsh gas is passed. Their electric resistance can be changed by the addition of 2½ per cent. of lamp-black to the furfuraldehyde. For the preparation of carbon rods for arc lamps finely powdered carbon is mixed with from 60 to 70 per cent. of furfuraldehyde, and the mixture subjected to powerful pressure in suitable molds. The rods thus formed are exposed to the action of gaseous hydrogen chloride, after which they are highly heated in closed crucibles covered with powdered carbon.

Silvered Incandescent Lamps for Reflecting Purposes.

It is now generally admitted that the immediate success of electric lighting by incandescence depends upon the introduction of some method whereby a considerable economy in working can be effected. The utmost quantity of light which can be obtained by the expenditure of a



WOODHOUSE & RAWSON SILVERED LAMP.

given quantity of force seems for the present to be reached, and thus the one hope of economy which remains is in more fully utilizing the light at disposal.

It is evident that, as a rule, a large portion of the light given out by incandescent lamps is lost by being thrown where it is not required. This may be remedied by the use of reflectors, to which incandescent lamps readily lend themselves, and a most ingenious and elegant form of which is that represented in the accompanying engraving.

The method of application is exceedingly simple, and consists, as will be seen, in forming a section of the globe into a concave mirror by depositing a thin coating of silver, by chemical means, on the outside of the lamp. The silver may be applied so as to throw the light either forward or downward, according to the position in which it is proposed to place the lamp.

Our engraving represents the lamp of Messrs. Woodhouse & Rawson, who have obtained several patents on the process of silvering incandescent lamps. Such lamps are specially adapted for use in such places as billiard halls, large rooms, and for ship and railway lights.

The Interdependence of Nature.

In a recent address before the Royal Society, Professor Huxley, speaking on the above subject, made the following terse remarks: "The interdependence of all the phenomena of nature is such that a seemingly unimportant discovery in one field of investigation may react in the most wonderful manner upon those which are most widely remote from it. The investments of science bear compound interest. Who could have imagined that a curious inquiry into the relations of electricity with magnetism would lead to the construction of the most delicate instruments for investigating the phenomena of heat; to means of measuring not only the smallest intervals of time, but the greatest depths of the ocean; to methods of exploring some of the most hidden secrets of life? What an enormous revolution would be made in biology, if physics or chemistry could supply the physiologist with a means of making out the molecular structure of living tissues comparable to that which the spectroscope affords to the inquirer into the nature of the heavenly bodies. At the present moment the constituents of our own bodies are more remote from our ken than those of Sirius in this respect. In the next place, the vast practical importance of the applications of scientific knowledge has created a growing demand for technical education based upon science. If this is to be effective it means the extension of scientific teaching to all classes of the community, and the encouragement and assistance of those who are fit for the work of scientific investigation to adopt that calling. Lastly, the attraction of the purely intellectual aspects of science and the rapid growth of a sense of the necessity of some knowledge of the phenomena of nature and some discipline in scientific methods of inquiry to every one who aspires to take part in or even to understand the tendencies of modern thought, have conferred a new status upon science in the seats of learning, no less than in public estimation."

The Cost of Gas in America.

The American Electric Manufacturing Company has compiled a very interesting table of the prices and candle-power of gas throughout the United States, and publishes it with comment as follows:

A careful investigation of all the statistics at hand shows that there are about 900 gas companies in the United States, employing a gross capital of about three hundred millions of dollars ($300,000,000). In New York City alone there is an aggregate capital of $45,901,000. The Consolidated Gas Company, which absorbed the Manhattan, New York, Metropolitan, Municipal, Harlem and Knickerbocker, controls $35,430,000 of this amount, the other six companies finding profitable employment for the balance—$10,471,000. The gross revenue to the companies in New York City for 1884 was $9,600,000, of which $4,600,000 was net, equal to a fraction more than *ten per cent.* on their entire capital.

When we consider statistics like these, remembering that the number of gas consumers in New York City alone is about 130,000: also in view of the fact that electric light, on the basis of *quantity of light produced*, can now be supplied as cheap as gas, it will be seen that the possibilities of the electric light in this country are enormous.

The following list of the prices charged for gas in some of the principal cities and towns of the United States is from the records of Dr. E. G. Love, the Gas Examiner for the City of New York. The figures represent the price per 1,000 feet charged to consumers during the summer of 1885, and the average candle-power of the light.

PLACE.	Price per 1,000 cubic feet.	Candle power.	PLACE.	Price per 1,000 cubic feet.	Candle power.
Albany, N. Y....	$2.50	18-19	Newark, N. J....	$2.00	19 20
Allegheny, Pa....	1.25	15	New Bedf'd, Mass.	1.87	18
Atlanta, Ga.....	1.50	17	New Haven, Conn.	2.00	16-17
Auburn, N. Y....	2.25	19	New Orleans, La.	3.50	19
Augusta, Ga.... .	2.50	19	Newport, R. I....	2.00	18
Baltimore, Md.. .	1.00	20	New York, N. Y.		18-30
Bay City, Mich..	2.25	19	Norfolk, Va.....	1.80	20
Boston, Mass....	1.50	19	N'th Adams, Mass.	2.37	18
Brooklyn, N. Y.	2.00 2.25	19	Omaha, Neb... ..	3.50	16
			Oswego, N. Y....	2.25	17
Buffalo, N. Y ..	1.80	20	Paterson, N. J....	... ..	.....
Cambridge, Mass.	2.00	17	Peoria, Ill.....	2.00	16
Camden, N. J.. .	1.50	17	Petersburg, Va...	2.50	17
Charleston, S. C..	2.50	18	Philadelphia, Pa..	1.70	16-17
Chelsea, Mass....	2.50	18	Pittsburgh, Pa...	1.00	18
Chicago, Ill....	1.00 1.25	19	Pittsfield, Mass...	2.40	18
			Portland, Me.....	2.00	17
Cincinnati, O.....	1.60	16	Poughk'psie, N.Y.	2.14	18
Cleveland, O.....	1.40	16	Providence, R. I..	1.80	17-18
Columbus, O.....	1.25	17	Quincy, Ill.....	2.25	16
Covington, Ky...	2.00	17	Reading, Pa.....	2.00	24
Davenport, Ia....	2.50	16	Richmond, Va. ..	2.00	17-18
Dayton, O.... ...	2.00	16	Rochester, N. Y..	2.00	18
Denver, Col.....	1.75	20	Sacramento, Cal.	3.00	18
Des Moines, Ia...	2.50	16	St. Joseph, Mo.. .	2.00	17
Detroit, Mich.....	2.00	18	St. Louis, Mo....	2.50	18
Dubuque, Ia.....	2.50	16	St. Paul, Minn.. .	2.50	14
Elizabeth, N. J...	2.50	18	Salem, Mass.....	2.00	17-18
Elmira, N. Y....	2.00	17	Salt Lake City, U.	3.00	16-18
Erie, Pa.....	1.90	17	San Antonio, Tex.	4.00	16
Evansville, Ind...	2.00	17	San Fr'cisco, Cal.	1.50	18-19
Fall River, Mass..	2.00	18	Savannah, Ga....	1.90	18
Fort Wayne, Ind.	2.00	18	Scranton, Pa. ...	1.62	28
Galveston, Tex...	4.00	18	Springfield, Ill.. .	1.50	18
G'd Rapids, Mich.	1.80	18-19	Springfield, Mass.	2.18	17-18
Harrisburg, Pa...	2.00	19	Springfield, O....	2.00	16-18
Hartford, Conn..	1.80	17-18	Syracuse, N. Y..	1.80	19
Indianapolis, Ind.	2.00	18	Taunton, Mass.. .	2.25	18-19
Jersey City, N. J.	.....	.....	Terre Haute, Ind.	2.25	20
Kansas City, Mo..	2.25	18	Toledo, O..... ..	1.75	20
Lancaster, Pa....	2.00	22	Trenton, N. J....	2.50	16
Lawrence, Mass..	1.90	17-18	Troy, N. Y.....	2.75	19-20
Louisville, Ky....	1.80	18	Utica, N. Y.....	1.95	22
Lowell, Mass.....	1.50	17-18	Vicksburg, Miss..	3.00	18
Lynn, Mass..... ..	3.00	18-19	Washington, D.C.	1.50	18
Memphis, Tenn...	3.00	16	Wheeling, W. Va.	.90	16
Milwaukee, Wis..	1.60	18	Wilkesbarre, Pa..	.90	22
Minneapolis, Min.	2.00	20	Wilmington, Del..	1.50	18
Nashville, Tenn..	2.10	18	Worcester, Mass..	2.00	18

In addition to what the pamphlet says, we may point out that, as is natural, the price generally is governed by nearness to, or remoteness from coal supply. There are exceptions, however, worthy of study. Of course, where coal is cheap, the electric light can also be furnished cheaply.

Incandescent Lamp Tests by the Franklin Institute.

We are in receipt of a communication from the well-known firm of Woodhouse & Rawson, London, in which they say:

"It was not our intention to take any notice of the published results of the Franklin Institute tests on incandescent lamps, as considering the very strong comments that had been made on the subject in the various electrical papers, we thought it most unlikely that any one would be misled by them. We have, however, been advised that unscrupulous persons—more especially on the Continent—have been taking advantage of these tests to disparage our lamps. We shall, therefore, be glad if you will allow us the opportunity of emphatically denying that any reliance is to be placed in them, and of placing before your readers the following facts:

"We were advised by our agent in America to have nothing to do with the tests, as they would not be reliable, the Swan, Maxim, and other makers of incandescent lamps, having refused to allow their lamps to be entered. We accordingly decided not to compete. Lamps, stated to be ours, were, however, entered without our knowledge or consent—half being actually supplied by the Edison Company, the chief competitors; and the rest were obtained from another electric lighting firm. While being admittedly run at 5 volts above what they were labeled, giving out up to 40 per cent. or 50 per cent. above the proper candle-power, they were placed in competition with lamps evidently most carefully made and tested beforehand."

The firm also say:

"While in many instances disagreeing with the methods adopted in the actual tests, we refrain from criticising them, as we are well aware of the many difficulties that have to be contended with. We merely add that we think the Institute ought to have seen that we were properly protected and advised of what was going on.

"We are glad to hear that there is some chance of complete tests being made in this country when every precaution will be taken to insure their being properly made."

The Heinrichs System of Arc Lighting.

In our last issue but one we described the dynamo machine of Mr. Chas. F. Heinrichs, and it now remains to describe his arc lamp, which possesses marked novelty, in that the carbons are curved, instead of straight.

In Mr. Heinrichs' lamp, or "electric candle," as he prefers to call it, four curved carbons in two pairs are employed; one pair constituting one electrode and the other pair the other electrode of the lamp. Each pair of carbons is arranged in nearly a complete circle, and both pairs are set at right angles to each other, the arc being formed at

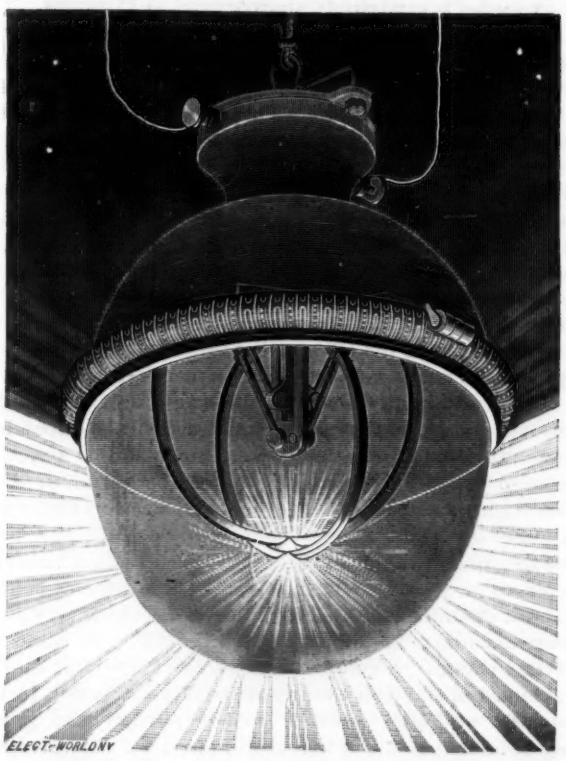


FIG. 1.—HEINRICHS SYSTEM OF ARC LIGHTING.

the crossing point of the two circles (or pairs of carbons) farthest from the lamp base.

We may remark that heretofore the use of four straight carbons in two pairs has been suggested, as in the Rapieff lamp, in which each pair forms a V, but for a number of reasons this form has not been successfully applied.

Our illustration, Fig. 1, shows the lamp as it appears in actual operation. The light, as will be noticed, is thrown downward and out at the sides without meeting obstructions.

As stated above, the arc is formed between the point of abutment or contact of one pair of circularly curved carbons, and the corresponding point of another similar pair below it, the planes of the two circles being perpendicular to one another, as shown in Fig. 2. The upper pair are both positive, being connected to the positive pole of the dynamo-electric generator, and the lower pair are negative, being in electrical connection with the other terminal of the machine. The feed of the carbons requires no mechanical apparatus such as clock-work or gearing, but is determined solely by the mechanical wasting away through the consumption of the carbon rods at their point of contact, the rods falling together by their own weight, as the carbon at their point of contact is dissipated under the action of the current.

While the feed of the carbons is determined by their consumption, the regulation of the length of the arc is

FIG. 2.—HEINRICHS SYSTEM OF ARC LIGHTING.

effected by electrical means, the strength of current flowing at any one time determining, by the simple contrivances described below, the degree of approach or of separation of the carbon rings.

By referring to Figs. 3 and 4 it will be seen that the upper or positive pair of carbon holders a^1 and a^2 are pivoted at the points s^1 and s^2 to two small equal-sized pinions p^2 and p^1 shown in the detailed plan, Fig. 4, which, by gearing into one another, render the swing of the arms a^1 and a^2 equal and symmetrical on each side of the vertical axis of the lamp. A similar method of pivoting is adapted to the arms a^3 and a^4, which are the holders for the pair of lower or negative carbons. The geared pivots of the upper pair are attached to the rod f, which is in its turn suspended from the long arm of the bell-crank lever l, of which the short arm is the armature e of an electro-magnet M, which, when the current passes through the lamp, by attracting the armature e lifts the rod f, and with it the upper pair of carbons, separating them from the lower pair, and thus establishing the arc. To prevent this lifting taking place with a sudden jerk, which might set the lamp jumping and upset at the same time the adjustment of other lamps in the circuit, Mr. Heinrichs has adopted the very simple and ingenious checking apparatus shown at p^5. This consists of a small rack forming part of the rod f, which gears into the small pinion p^5, on which is the large notched wheel w, against the teeth of which presses the light click spring s^4, and prevents any sudden vertical movement of the rod f, to which the upper carbons are attached. The lower or negative pair of carbon rods are attached to and in electrical connection with the framing b^1, which, while being insulated from the case of the lamp and positive terminal l^2 by the ebonite washer i, is connected by a wire to the negative attachment screw of the lamp l^1, seen to the left of the figure.

$R\,R$ is a coil of insulated German silver wire whose resistance is about equal to that of the arc, and its use is to prevent the other lamps in the same circuit being affected by the cessation, through any cause, of the arc of the lamp of which it forms a part; for the moment that the current ceases to pass from one pair of carbons to the other it is shunted through $R\,R$ by a very simple contrivance, and as the resistance offered by the coil is practically equal to that of the arc which it supplants, the strength of the current throughout the rest of the lamp circuit is not affected by the interruption. It also enables one of the lamps to be extinguished without affecting the others of the same series. The arrangement by which the circuit of $R\,R$ is substituted for that of the arc when the latter is interrupted is shown in Fig. 3. On the rod f is fixed a projecting pin p, which, when the rod drops, brings the contact spring s^3 against the contact screw c^5, which is connected to b^1, and by the wire b to the negative terminal. The same action brings the two pairs of carbons together, and in this position a current entering at l^2 has two courses through the lamp open to it, one through the resistance $R\,R$ and the other through the carbons and through the magnet coils M. The latter portion of the circuit causes the carbon to be separated by the lifting of the rod f, the arc is thereby established, and the pin p^1, rising with the rod f, releases the spring s^3 from the screw c^5, thereby cutting the resistance $R\,R$ out of the circuit and allowing the whole current to pass through the carbons and the arc.

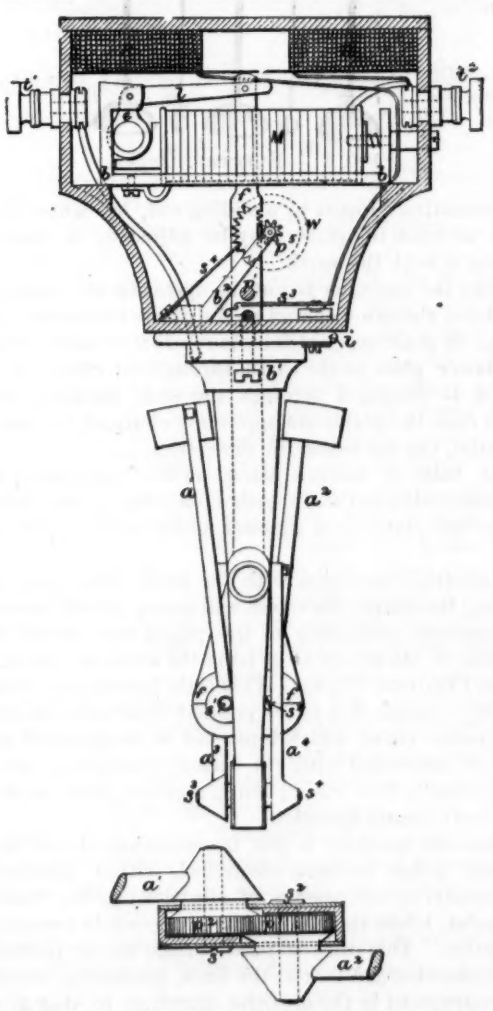
Fig. 4 is a diagram showing the very simple and ingenious method of construction of the pair of pivoted joints of the radial carbon holders a^1 and a^2. In this figure it will be seen that the two pinions p^2 and p^1 which are geared together are rigidly attached respectively to the radial arms a and a^2, turning on the pins s and s^2, which are fixed to opposite sides of the little framing, and the pinions are simply pushed over the pins from opposite sides, and are so proportioned that when pushed against their respective stops the pinions are in gear and the rods are in their proper position, the axes of their carbon-holders lying in the same vertical plane.

It is evident that the form of carbon employed allows of obtaining a considerable length of carbon in a small linear space. Thus with a diameter of one foot the carbons have an effective length of nearly 3 feet and can burn for a period of time equivalent to a length of 3 feet of straight carbon.

Mr. Heinrichs' lamp, which we have seen in operation, works very satisfactorily and has evidently merits of no mean order. We may add that for indoor purposes the upper frame is transparent.

The Demand for Underground Wires in England.

A dispatch from London, on Friday last, says: The morning papers devote much space to a demand that all telegraph and telephone wires shall be buried. The recent snow-storm—the first in five years that has so astounded Londoners—broke many overhanging wires, causing accidents and commercial delays. Three-fifths of these wires



FIGS. 3 AND 4.—HEINRICHS SYSTEM OF ARC LIGHTING.

are telephone and private ones. As to the government wires, the substitution of underground for overhead wires has been gradually going on, and at the present time the department has, within the metropolitan district, about 9,000 miles of line (wire?) carried in pipes to less than 1,000 stretched on poles.

The wires from the General Post-office are conveyed beneath the footpaths as far as Denham, beyond Uxbridge, a distance of 23 miles; to Hounslow, to Hadley, near Barnet; to Bromley, in Kent, and to other places, whence they branch into open roads, following the highways or canals to the provinces. Other pipes connect with the great railways. These tubes extend below all the important city thoroughfares, the largest tubes containing 110 separate lines.

Through Newgate street no fewer than 412 concealed wires run, and down Cheapside there are three pipes, each carry-

ing over 80. How enormous the telegraph business is here the statistics published this morning show. On Wednesday last, the day of the snow-storm, there were transmitted from one part of London to another 13,936 messages. The gross number of telegrams dealt with at the central office was 64,770. Now doubtless will come the same kind of discussion regarding buried wires as is going on in New York.

Static Electricity.

BY PHILIP ATKINSON, A. M., PH. D.

CHAPTER VII. (*Continued*).

THE ELECTRIC CHIME.—This instrument is used in connection with the machine, to illustrate electric attraction and repulsion.

It may be mounted on a separate stand, or hung from the projecting rod of the prime conductor. Fig. 31 represents a common style used in this way.

It consists of three bells suspended from a brass rod; the two outer ones by brass wires or chains, and the central one by a silk cord, a brass chain connecting it with the earth. Between the central and outer bells are two small brass balls, suspended by silk cords.

When the machine is put in operation, the outer bells receive a charge from the prime conductor; this acts inductively on the insulated balls, which are at zero, attracts, and, after contact, repels them.

Being now charged the same as the outer bells, they act inductively on the central bell, repelling or attracting electricity through its chain, according as their charge is positive or negative; and producing on it a charge of the opposite kind, they are attracted to it and discharged.

Being now at zero, they are attracted to the outer bells, as before, and in this way the three bells are made to ring.

IMAGE PLATES.—These are used to show the effect of induction between two conducting surfaces, as represented by Fig. 32.

From the projecting rod of the prime conductor, a brass plate, having a resistance rim, is suspended by a wire or chain, and under it, on an insulating stand, is placed another similar plate, made a little larger, and joined to

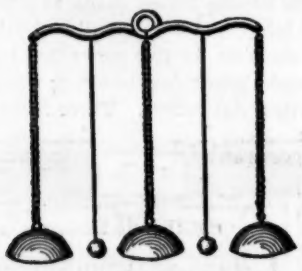


FIG. 31.—ELECTRIC CHIME.

the insulating support by a sliding rod, by which the distance between the plates may be adjusted, a chain connecting it with the earth.

When the machine is put in operation the upper plate will have the same charge as the prime conductor; if the charge be positive, electricity is repelled by induction from the lower plate to the earth, through the chain; if negative, it is attracted through the same medium; and, in either case, the plates are oppositely charged to the same potential, the air being the dielectric.

Pith balls or images, placed on the lower plate, are alternately attracted and repelled, dancing up and down between the plates in a manner which is often quite amusing.

If electric connection with the earth be severed by removing the chain, this effect will cease, which proves that the opposite potentials of the plates was caused by the transfer of electricity to or from the earth as stated.

THE ELECTRIC WHIRL.—This little instrument, shown in Fig. 33, consists of a set of pointed brass arms attached to a common centre, which is pivoted on the point of a vertical rod connected with the prime conductor, the arms being bent so that when passing a given point each shall turn in the same direction.

When the machine is put in operation, the air in front of each point becomes electrified, either positively or negatively, by the passage of electricity either from or to the point, while that back of it is oppositely electrified by induction. This causes repulsion from the air in front and attraction toward that at the back, producing rotation of the instrument in the opposite direction to that in which the points turn.

The effect of a stationary point in producing a current of air is shown in Fig. 34, where the flame of a candle is represented as blown from a point attached to the prime conductor.

The direction of the air current will be the same whether the charge is positive or negative, since, in either case, the air embraced within a sphere of which the point is the centre, will have the same potential as the prime conductor, while that outside of this sphere will assume the opposite potential by induction. Hence the air near the point becomes self-repellant, and is also attracted by the air outside; that directly in front of the point being repelled with the greatest force, produces a current in that direction, while the air on either side is attracted, and, in its turn, again repelled.

(TO BE CONTINUED.)

Edison at Work.

One of the newspaper reporters looked in upon Mr. Edison a few days ago, and, as usual, was rewarded for his trouble. Below is his story:

Greater things are in store for the public than the telephone by the wizard of Menlo Park. Yesterday a reporter for the *World* saw the inventor of the electric light seated at a bench of wonderful machinery with ingenious mirror appliances attached to all its points for concentrating the rays of an electric light and throwing them upon a highly polished disc, tracing thereby the minute waves of sound from a new cylindrical apparatus—a newly constructed phonograph—and reflecting them a

FIG. 32.—IMAGE PLATES.

hundred-fold amplified upon a larger disk at a distance of three feet.

"I am now perfecting the phonograph," said he, as he looked up with a kindly smile. "I have done nothing to it since 1878. All my time since then has been directed toward perfecting my light. I have now some time on my hands, and I have resumed my study of the phonograph. No one has touched or sought to make any use of it. See here, I have just made a photograph of the expression 'Ah!'" Here the inventor produced a strip of paper twenty-one feet long by two inches wide, from one end of which to the other was a continuous line of waves, making one "wave sound." "That is 'Ah!'" resumed the magician. "Of course, this is only experimental, but the machine that would produce that sound would be heard five miles away distinctly."

"There is, then, an ultimate future for the phonograph?"

"Yes, a great one. I intend to make it of use for commercial purposes. It will be used for dictating to. In offices it will take the place of stenographers, and boys can use it. This is the machine I am now constructing. This phonograph was complete so far as it went, and gave satisfaction to all those who were then interested in it. Its mission I am about to demonstrate. The phonograph I am building will have a five-foot wheel, to be driven by steam. The sound will be transferred from the phonograph to a wheel forty times its diameter, the sound thus being amplified forty times, making it forty times louder than the human voice. It will have a funnel 30 feet long. I will put it on top of this building—(Bergman & Co.'s, foot of East Seventeenth)—and you can hear it talk distinctly two blocks away.

"This is only to prove the perfection of my new machine. I shall then construct the new phonograph for office use. It will be self-acting, worked by a spring.

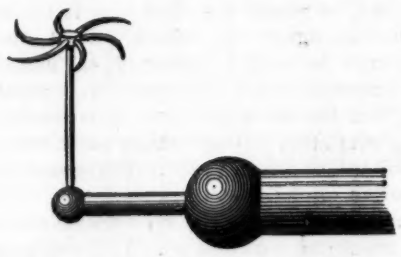


FIG. 33.—THE ELECTRIC WHIRL.

Bankers, merchants, lawyers and editors can stand up and speak to it, or can recline upon a lounge, smoke their cigars, and dictate to it at their ease. All they have to do then is to hand it to the office boy, who, by touching a spring, can make it talk back or repeat all that has been said to it, which he can transcribe at his will. If he misses anything he can spring it back, when the phonograph will repeat it over again. Whoever possesses one can take it home, and if a thought, an idea strikes him, he can instantly confide it to the phonograph, and there it is for him next day. The stenographer is an expensive institution in an office. This will take his place as a complete registering machine."

The Lowell Telephone Syndicate Pays $32,000.

A dispatch from Lowell of Jan. 6 says: "The suits of the Erie Telegraph and Telephone Company against the old local telephone syndicate—William A. Ingham, Charles J. Glidden, Loren N. Downs, William H. Bent and Alonzo A. Coburn—were settled to-day. By the settlement the Erie Company recovers $32,000 and interest, amounting in all to about $36,000. In July, 1883, when the above syndicate were officers of the Erie Company, they purchased the Southeastern Dakota Telephone and Telegraph Company for $70,000, and the Arkansas Telegraph Company for $25,000, and turned them over to Erie for $77,000 and $50,000, respectively. The Erie Company brought the suits last September to recover the commissions unlawfully taken, and the syndicate have made payment rather than take the matter into court. Gen. B. F. Butler and William H. Anderson were counsel for Erie, and D. S. and G. F. Richardson for the syndicate. William A. Ingham was seen at his residence this evening. He says that the syndicate is well pleased with the outcome of Erie's suit against them, whereby they paid Erie $36,000 to-day. Ingham says the end is not yet, and that Erie owes Glidden, Downs and himself $26,000 unpaid salaries." Mr. Glidden, treasurer of the company, makes no claim for back salary, however, saying that it was generally understood that the syndicate served gratuitously, accepting a vote of thanks at the annual meeting from the directors for their services. Against the claim of the others, the company makes a counter-claim for $150,000, construction money squandered by mismanagement and bad investments. The $32,000 refunded reduces Erie's debt to about $14,000.

Our Patent System and its Defects.

Considering the number of patents that are issued each year, and also the number that are at present in force, it is fair to assume that the public at large are interested in the work of the Patent Office, and in the general patent system of the country. There are very few industries indeed, says the *Iron Age*, which are not more or less fostered and sustained by patents, and much of the litigation that occupies the courts in all the States bears directly or indirectly upon patent rights. The Patent Office has for many years past been more than self-sustaining—that is, the fees which have been exacted from inventors have been in excess of the expense of conducting the department. That this is so, however, is in part explained from the fact that the Patent Office has no control over its own funds, and that it is denied what ought to be expended in the interest of its work.

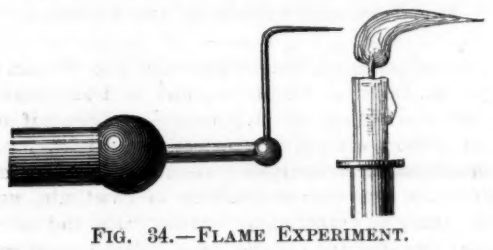


FIG. 34.—FLAME EXPERIMENT.

Whatever is collected in the way of fees is covered into the common treasury of the government, and whatever is expended is grudgingly appropriated by Congress. The result of this management is a handsome balance to the credit of the Patent Office, but the plan is greatly opposed to the best interests of the patent system, and to inventors at large. The United States Patent Office stands in great need of many facilities and conveniences which would materially aid in the work, and which a more liberal policy would secure. It is short-handed in many divisions, and is lacking in various respects that would be unnecessary were its own funds expended as they should be. This, it seems to us, is great injustice to inventors as a class, and is directly opposed to the interests of those industries which depend in a great measure upon patents. Among the more pressing needs of the office at the present time, which are apparent to outsiders, there may be mentioned the want of a larger examining force, and the creation of several additional classes, so that work would not only be dispatched more rapidly, but also that greater care could be taken in those investigations which determine whether an application for a patent shall be answered affirmatively or denied. Another need that is conspicuous to any one who examines the internal workings of the office, is the want of more references available to examiners. There are conspicuous gaps or omissions in the files of the office, which very often leave examiners in doubt as to the propriety of allowing certain claims. A comparatively small amount of money expended in this direction would be of great benefit to the country at large, since it would prevent the granting of many patents of a doubtful character, the existence of which often leads to costly litigation. Our patent system at present is so conducted that there are too many patents issued in proportion to the inventions made. There are very few classes in which the ground has not already been more or less covered by inventors, accordingly what most readily suggests itself is the recombination of old elements, thereby securing modified results. The very slight novelty which the office at present recognizes as being sufficient to warrant granting a patent, tends in itself to reduce the value of all patented property. If the standard was made higher, and if greater facilities for search were provided, very advantageous results would follow.

Much has been done in the office during a few years past in the way of index files, but an intelligent system of cross indexes, which would facilitate searches by taking into account correlated industries, would facilitate the work of the office very much, and is something the office should

have, in order to make much that has already been done available. Still another defect in the system may be mentioned. There is, we believe, no provision at present by which an examiner or an assistant examiner can leave the office to examine the state of an art in any particular direction. An examiner may be sure, for instance, that he has seen a certain form of railroad switch or railroad frog in use years before in a certain place, but when an application for a patent on that identical thing comes from an inventor in another section of the country, and the records of the office do not show the invention, he is forced to pass the application. In rare instances the inventors have been known to pay the traveling expenses of examiners in order to show up their inventions, and to give them a correct idea of the state of the art and the measure of their improvement. But, unless the inventor or some other interested person defrays traveling expenses of this kind, the cost of such trips falls upon the individual examiners. It is needless to say that under these circumstances comparatively few trips of the kind are made. So rigorous are the rules in this respect that in one instance that has come to our knowledge, an examiner was even charged against his legal vacation with one day's time that he had spent away from the office on business of this nature. In order to conscientiously perform his duties he had paid his own expenses, and had taken a day's time to investigate the operation of certain machinery on which a patent was pending. On applying for his usual vacation a long time afterward he found the day off for this purpose had been charged against him. The room allotted to the Patent Office is at present insufficient for its needs. The Patent Office is a subdivision of the Interior Department, and other offices of the various branches of the Interior Department are quartered in the so-called Patent Office building. Were the entire building devoted to the needs of the Patent Office, this complaint of lack of space would have no foundation. As it is, however, the corridors of the building are of necessity used to hold cases and files that belong in the examiners' rooms. There is confusion in various directions which more room would remedy. We might enumerate still other needs, but enough has been presented to show that a change in the matter of appropriations would be advantageous. It scarcely needs argument that the money derived from patent fees ought to be expended in furtherance of the patent system. It is the inventor's right. Just what legislation is necessary to carry out this plan it is not our purpose at present to discuss. If the Patent Office could be divorced from politics, if civil service in its highest and best sense could prevail in its management, and if commissioners of patents could be found who are not only competent men, but who would accept the office as a trust to be held for years, instead of a short time, until the opportunity of entering upon a profitable private business presented itself, still greater advantages would be gained.

Mechanical Telephones.

BY A. M. ROSEBRUGH, M. D.

The article on the Mechanical Telephone Exchange in THE ELECTRICAL WORLD of Dec. 26 interests me, as I believe there is a field of usefulness for the mechanical or acoustic telephone not yet fully realized.

I have given some attention to the subject, and last August, while in London, I submitted a plan of an exchange system to Prof. S. P. Thompson, and he was so well pleased with it that he insisted upon taking me off at once to see his solicitor, with a view of securing provisional protection in Great Britain without delay. I hope to be able to furnish the readers of THE ELECTRICAL WORLD with a descriptive article on the subject at an early date.

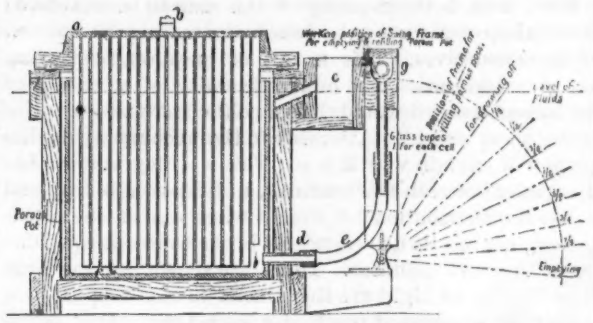
In order to be popular, the mechanical telephone requires, first, an efficient exchange system, and, second, a responsible company to both construct the lines and keep them in working order afterward. Heretofore the instruments have been sold outright, and the purchasers have constructed their own lines as best they could. As a result, the lines have, as a rule, been very badly constructed, and disappointment has occurred, especially where long stretches have been attempted. Harm is also done by the manufacturers' exaggeration of the capabilities of their instruments. They are sometimes advertised to work "from one to two miles." I think it very doubtful if they have ever worked satisfactorily even one mile. If they will work half that distance, and the lines be kept in good repair, the mechanical telephone will have a field of usefulness all its own.

Battery for Domestic Electric Lighting.

For some time past the Ross primary battery for electric lighting has attracted considerable attention abroad, and a number of houses have been successfully lighted by it.

The elements consist of zinc and carbon; the former is surrounded by an acidulated solution of common salt, and the latter by a depolarizing solution, the nature of which is kept secret. It is stated that the Ross primary battery will run with efficiency considerably below the maximum for twelve hours, without sensible falling off in the intensity of the current, and then all that is required is that a small portion of the depolarizing liquid should be drawn off and the cell filled up with an equal quantity of fresh solution.

The accompanying illustration shows the arrangement adopted for doing this conveniently. From the bottom of each porous compartment *f* there proceeds a pipe *d* which bends upward and terminates, at a higher level than the liquid in the cell, in a horizontal pipe *g* running the entire length of that section of the battery. The upright pipe is jointed at the bend by means of a short length of india-rubber tube *e*, and can be inclined outward until the liquid which stands in it flows over the upper edge into

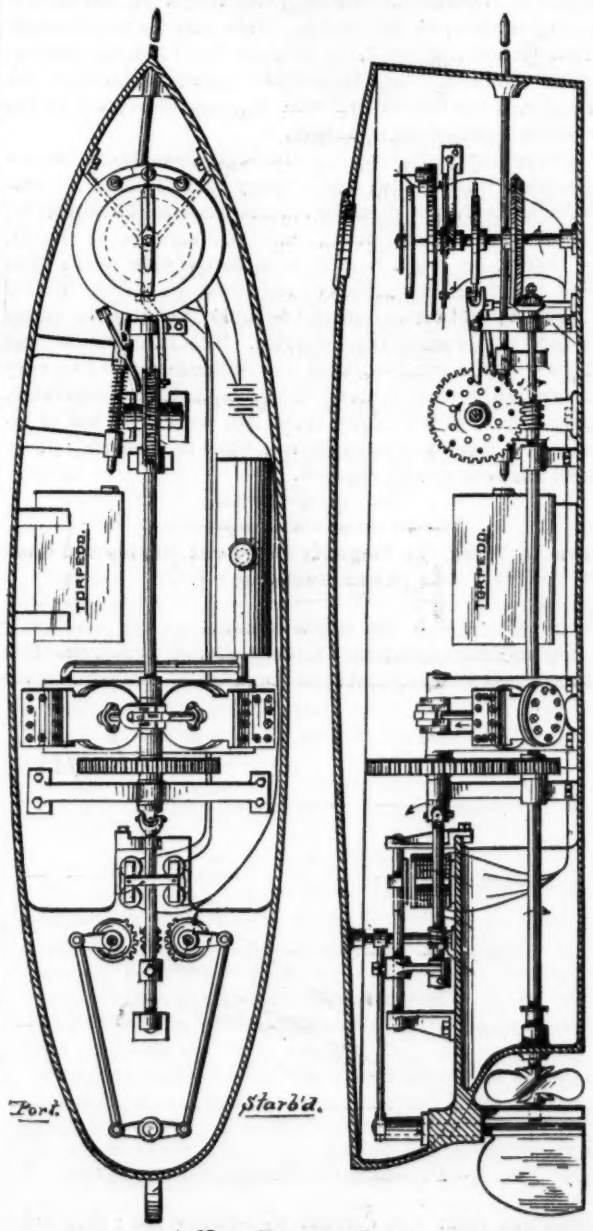


PRIMARY BATTERY FOR DOMESTIC ELECTRIC LIGHTING.

the horizontal pipe. All the pipes of the cells constituting a section of the battery are connected together by a frame, and are inclined together. The spent portion of the depolarizing liquid, being the heaviest, sinks to the bottom of the cell, and can be thus drawn off. After it has been removed fresh liquid is poured into the horizontal pipe from a reservoir, and the previous level is regained. The trough *c* serves for the introduction of the acidulated water into the zinc cells.

A New Torpedo Boat Steered by Electricity.

Submarine warfare now claims the attention of all powers as the new mode of attack by torpedo may be considered the most effective since the advent of the modern heavily armored war-vessel. The penetration of the latter's armor by a shock from a heavy gun would, in but few cases, cause its disabling, and hence it has come to be recognized that attack below the water line is of the utmost importance. Many devices of submarine torpedoes have been conceived, some leaving the torpedo independent when once launched, as the Whitehead; others again, as the Lay and Sims, are controlled from the launching point on shore or ship-board. In the latter class the direction is controllable by electricity, as a rule, and subject to manipulation; but in a recently patented torpedo, devised by Mr. Horace P. Griswold, of Providence, R. I., a decidedly new departure has been taken. In the older forms of torpedo any deviation from the true course was corrected, but in his form the torpedo is not specifically directed to the object, as will be explained presently.



A NEW TORPEDO BOAT.

Our illustrations show a vertical and a horizontal section of the torpedo. Its motive power is derived from an engine using a compressed gas contained in a reservoir. At the bow there is placed a magnetic needle provided with a small contact finger, and below it there is placed a dial with mercury cups so that when the contact finger dips into the mercury an electric circuit is closed. This dial is put in connection with a clock work which is so arranged that it is turned through 180 degrees at certain fixed intervals of time. The electric circuit, as will be seen, includes two electro-magnets at the stern, and between them revolves a spindle provided with a worm which is constantly revolving. The rudder is provided with arms which are connected to worm-wheels, and thus, as each magnet is energized the corresponding worm-wheel is brought into gear. By this means the rudder is put to port or starboard, as will be readily understood from the illustration.

The object sought by this arrangement is to launch the boat and to make it pursue a course until it strikes the desired object. Thus, the clock-work is so arranged that, as stated above, it revolves the dial 180 degrees at certain intervals. Now, the torpedo being launched, it follows a straight course of say 1,000 yards. The clockwork then reverses the dial, closes a circuit, the corresponding electro-magnet attracts its armature, and the rudder is set say to starboard. The torpedo then reverses its course and follows a line, say 100 feet from the first and for a distance of say 500 yards. At this point it is again reversed by the dial and goes in the original direction and another 100 feet from its second course, and so on. Now, supposing a ship 300 feet in length to be interposed between this zigzag course, the torpedo would be bound to strike it at some point, since the difference in the courses is only 100 feet. The torpedo is provided with a projecting firing pin, and any contact with an external body causes the explosion to take place.

The clockwork is so arranged that in the present apparatus the last course taken by the torpedo is always directed toward the shore, and hence the torpedo, if it fail to strike from any cause, will be recovered. It is also provided with an arrangement such that if it fail to strike an obstruction after the lapse of a certain time, the firing mechanism will become inoperative, and thus prevent an explosion upon the return of the torpedo.

It will be noted that by this arrangement the engine is never reversed, the direction of the torpedo being regulated entirely by the rudder and dial.

Application of Electricity to Propulsion of Elevated Railroads.*

BY FRANK J. SPRAGUE.

When, only a few years since, against all the hue and cry of its opponents, but in answer to the growing demand for rapid transit, the elevated railroads in New York were projected and finally constructed, I doubt if their most ardent supporters looked forward to the fact that in 1885 the roads could not accommodate the number of passengers who wish to be carried. But so great has been the growth of the city, so rapidly has the business section pushed to the northward and forced large numbers of the people, especially the laboring classes, to seek homes at the upper limits of Manhattan Island, where rents, already increasing because of increased facility of access, are still lower than could be readily commanded for business purposes in the lower part of the city, that the roads at night during the commission hours are now taxed beyond their present resources, and the demand is urgent that their carrying capacity be increased, or that new routes be opened for the accommodation of the public. But new roads require time for construction. Undoubtedly there will eventually be an underground system, and for through traffic this presents the most satisfactory solution, but for a score of reasons, unnecessary to mention here, this road is one of the future, not of the present. Yet the city is growing rapidly, homes are pushed farther and farther to the north, and the great army of workers who must every day travel from end to end of the city is steadily increasing. Most urgent, then, is the necessity for additional means of transportation, and, for the present at least, by the elevated railroads.

There are four of these: the Second, Third, Sixth and Ninth avenue lines, the last two merging into the Harlem extension.

In considering how the capacity of the roads may be increased, it is necessary to note the character of the roads and their method of operation, and for that purpose we will take the Third avenue line as an example. This extends from the Harlem River to South Ferry, and has a length of about eight and a half miles. With the main features of the construction of the road-bed you are all familiar. It consists of a series of built-up wrought iron columns of various heights, the bases resting in solid stone foundations and supporting a superstructure of lattice girders, making up a very strongly braced web system, on which are laid the ties and rails of a complete double-track road, with all the necessary arrangements of switches and sidings.

Because of the undulatory character of the streets, the road-bed is a continuous succession of widely varying grades with frequent short level spaces. The grades vary from 8

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to 105 feet to the mile, and the aggregate of the level stretches amount to about one-third of the whole distance. Almost all stations are at level grade, and hence a good portion of the aggregate is at points at which power is not applied for traction. As an example of the undulatory character of the road, take the section from Fifty-ninth to Ninety-eighth street. Leaving Fifty-ninth street on the up track, the grade runs almost immediately at 80 feet to the mile for a lineal distance of about 1,800 feet. Then comes a level stretch for 1,100 feet, a 100-foot down grade for 1,300 feet, another level of 900 feet, a 95-foot up grade for 1,500 feet, a level of 1,700 feet, a 105-foot down grade for 2,200 feet, a short level, and so on throughout the whole length of the road.

In the seventeen miles of single track there are altogether fifty-two stations. A train weighing, as often happens, over ninety tons, must make the trip from South Ferry to Harlem River in about forty-two minutes, including stopping at twenty-six stations and discharging and taking on passengers. This is at the rate of only about ten traffic miles per hour. Surface railroads stopping at any street corner make six miles per hour. Hence it is evident that the elevated railroads cannot afford to make any slower time than at present. If they could run faster, their traffic would be very materially increased.

A moment's consideration, then, will show the remarkably difficult character of the work done by the engines on the elevated railroads. Three times in every mile they must start a weight oftentimes as high as ninety tons from a dead rest, raise it up to a speed of nearly twenty miles an hour, propel it a short distance at that speed, overcoming not only inertia of the train and the traction which is required for the train on a level, but also climb steep grades, and then suddenly bring the train to a rest. All this must be done in a minute and a quarter of time. Of course this work varies greatly between every station, being much less between those stations where there is a down grade. Without now going into the details, which I will give later, the mean work of the locomotives is three times that necessary to draw the train at its mean speed of about fifteen miles an hour on a level grade; and in getting under way and climbing the 105-foot grades, the work of the locomotive is at least seven times that required for the mean speed traction on a level.

The acceleration of the train on the down grades and the momentum stored up in the train in getting under way, play but little part, except on the down grades, in propelling the train, because the stoppages are so frequent and are made in such short distances that advantage cannot be taken of much of this stored-up energy. Hence the large proportion of this is thrown away.

With cars of a seating capacity of forty-eight and room to accomodate forty more standing, it is evident that the capacity of each car of the train cannot well be increased, and the capacity of the trains can only be increased by increasing the number of cars. There are already sixty-three trains in operation at one time on this road during commission hours; they run at very close intervals, and they must be under the most perfect control. Every car added increases the momentum of the train, rendering it more difficult to quickly and efficiently check the speed, and increasing the liability of and the danger from any derangement of the brake apparatus, especially where dependent upon one source. If the length of trains be increased, admitting that they can be handled without difficulty, the engines will be forced to a duty much beyond that for which they were constructed.

The following details of an indication of power taken on the Sixth Avenue road from an engine similar to those in use on the Third Avenue, will be of interest:

Cylinder, 11 inches diameter, 16 inches stroke.
Driving wheels, 42 inches diameter.
Speed, 15 miles per hour.
Boiler pressure, 130 pounds.
Average effective cylinder pressure, 100 pounds (by indicator).
Indicated horse-power, 2 cylinders.....184.3 h. p.
Deduct 10 per cent. for friction of engine..... 18.4 h. p.

Net for traction.....165.9 h. p.
Net tractive pull, 4,147 pounds.

Mr. Angus Sinclair in experiments recently conducted on the Third Avenue line, found that the mean cylinder pressure for all the time steam was on the cylinder for a round trip was 81.7 pounds, and the mean horse-power indicated was 163.4.

These are high effective pressures and powers for engines of these dimensions.

Furthermore, when the tracks are in a slippery condition, the weight of the engines does not now give sufficient rail adhesion to promptly get away from the stations. An additional car will render this delay more frequent and tend to reduce the traffic miles per hour run during commission hours. To get increased traction in the present system, it is absolutely necessary to increase the weight of the locomotives, but such increase of weight is useless unless it be effective on the drivers; but if effective on the drivers, then we have an increased dead weight applied to the superstructure of the road at one point.

Four things at least operate against the superstructure of the elevated railroad: First, the thrust of moving weights ascending the grades tending to vibrate the structure; second, the vibration due to the shifting of the weight along the girders between the columns, which is very much greater with the locomotive than with a car, because of its greater weight, the traction exerted by its wheels, and the reciprocal thrust on the drivers; third, the crushing strain on the columns and the tensile strain on the girders, the latter greatest, of course, when the weight is midway between the columns; fourth, the shearing strain on the rivets. These cause the repairs and occasional reinforcements found to be necessary to the superstructure of the Third and Sixth Avenue Elevated roads, made more necessary by the increased travel. These repairs are, of course, a heavy charge against the operating expense of the roads.

How, then, is the capacity of this road to be increased? It certainly ought not to be done by increasing the traction of the locomotives. This is out of question, for leaving out of consideration the impracticability of a change of the locomotives, it would be impolitic and unwise to increase their weight. Attention to the accompanying diagram will explain why it is so: This is a diagram of a lattice girder between two columns, a distance of 43 feet, and shows the distribution of weight when one of the standard engines has its drivers nearly in the centre at equal distance from the columns. These are shown by the large circles. On the right are the trucks of the engine. On the left is the forward truck of a loaded car. This distri-

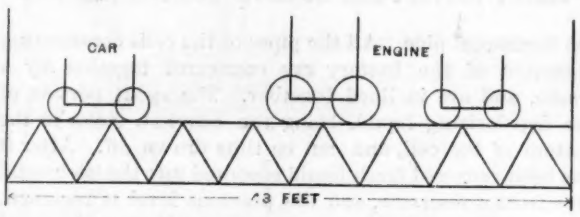


DIAGRAM OF DISTRIBUTION OF WEIGHT.

bution gives the greatest shearing strains on the rivets. The locomotive weight is 22½ net tons, or 45,000 pounds, of which 15 tons only are carried by the drivers, and are effective for tractive power. The other 7½ tons are supported by the trucks. One-half the weight of the car following is about 17,500 pounds. This gives a total weight of 62,500 pounds, or 1,454 pounds per running foot between columns. Any increased weight to increase the traction of the locomotive will increase the strain at the weakest point of the structure.

It is necessary to keep up the high character of the engineering work of this road; every consideration of prudence and safety and public interest require that under no circum-tances or conditions shall the strain on the chords, or braces, or rivets exceed a perfectly safe limit. The road has been remarkably free from accidents of this character, notwithstanding the great number of trains and the hard conditions of service. This is, of course, due to good engineering work in the beginning, and to a very careful and critical system of administration, inspection, and repair. It is evident, then, that we ought not to increase the weight of locomotives, since the shearing safety limit has been nearly reached.

(TO BE CONTINUED.)

How to Wind the Magnets for Shunt, Series and Compound Machines.—I.

BY CARL HERING.

In building dynamos of the ordinary types, the first thing to do is to calculate the diameter of the wire on the

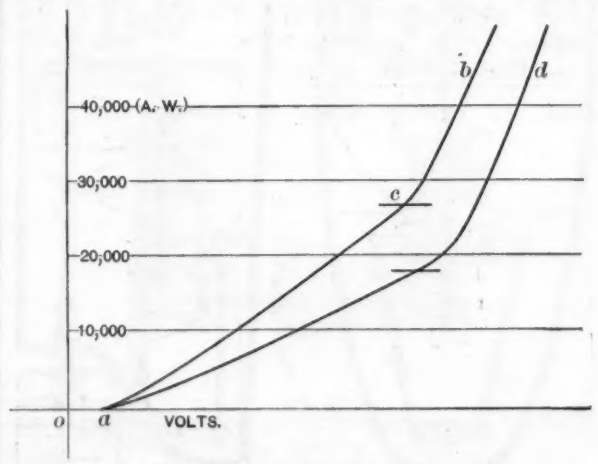


FIG. 1.—DIAGRAM OF MAGNETIC SATURATION.

armature from the current to be delivered; then determine the number of turns, the diameter and length of the armature, as nearly as one can, from the electromotive force required; construct the frame by comparison with other finished machines, and determine upon the maximum speed allowable, which latter depends upon the diameter and weight of armature, length of shaft between bearings, rigidity of the frame, etc. Having done this, it is then necessary to determine the winding of the magnets, in order that, with this speed and armature, the machine may give its required electromotive force, or its constant potential, as in the case of compound machines. A description of a method of doing the latter without the factor of uncertainty, so often included, is the object of this article.

It is evident that by winding the field magnets similarly to another machine giving a different current or electromotive force, the former machine will give approximately the required electromotive force or current (depending upon the correctness of the calculation), and that the speed may then be varied until it gives the exact electromotive force. But it is a very uncertain method, for it is very difficult, in most cases, to make the proper change in the winding to correspond with the required change in the electromotive force, and, therefore, the chances are that the necessary speed obtained by experiment will either be too high to make the machine safe and durable, or that it will be too low to give it the required efficiency for the size and cost of the machine.

There is a sure and tolerably exact method, used by the writer, for determining the winding in order that the speed may not be too high or too low; that the brushes may be placed in the proper non-sparking position; that the magnet coils may have the proper resistance, so that they absorb the proper percentage of energy allotted to them, and in order that the cost of the wire on the magnets may not be too great; or that the total energy delivered by the machine may not be too small for its size and cost. By means of this method, the factor of uncertainty, or good (or bad) guessing, is entirely eliminated.

It is well known that the current of a machine depends on the size of the wire on the armature, so that if the armature is determined, that limits the current, at least within certain bounds. The only thing left to do, therefore, after the armature and frame are determined upon, is to make the machine give the proper electromotive force with this armature, while it is delivering the proper current, at the given speed.

As the electromotive force depends upon the speed, the number of windings on the armature, the size of the armature and the magnetism of the field magnets, it is evident that if the armature and frame are completed and the speed decided upon, the only thing left to vary, in order to make it give the electromotive force, is the magnetism of the field magnets.

In order to determine this, erect the machine with its proper armature, run it at its proper speed and wind some temporary coils to fit the magnets, being careful to note the exact number of turns of wire on these coils. Now run the machine at its proper speed, discharging the current from the armature directly into a large rheostat, lamps, a tub of acidulated water, or the like, and excite the field magnets with the current from another machine or secondary battery. It is then only necessary to increase or diminish this exciting current, and to regulate the rheostat in which the current is absorbed until the current delivered by the armature is the proper amount and has the required potential, when the brushes are set to the proper non-sparking position. It is evident that this will enable one to properly adjust all the parts and conditions, and will allow of any slight changes of speed, or the like, which the running of the machine may show to be necessary. When it is running properly and has been "warmed up" sufficiently, measure the exciting current.

The intensity of a field is proportional to the ampère windings or ampère turns on the several magnets, that is, to the number of ampères flowing through the wire multiplied by the sum of the number of turns on all the magnets. It is immaterial whether the current be large and the number of turns small, as in a series machine, or *vice versa*, as in the shunt machine, or whether it be a combination of both, as in a compound machine, if only the product of the current into the number of turns be the same.

The measurement made as above described will therefore, if the ampères of current be multiplied by the number of windings in the coils, give us the proper ampère windings required to make the machine give its required electromotive force when delivering the proper current. It remains only to calculate the proper size of the wire and the number of turns from this given quantity of ampère-windings in order that the finished machine may have the required intensity of magnetic field or the same ampère-windings. This size of wire will, of course, depend on whether it is a shunt, series or compound machine, also on the allowable current or fall of potential in the magnet coils, on the cost of the wire, etc.

Before giving the formulæ in the three special cases, it may be well to call attention to some points which apply to them all.

The temporary coils may be wound on a shell of common tinned iron or the like, to fit the magnet cores. They must all have the same number of windings, and had better be connected in series, for if they are in parallel arc you are never sure, unless the resistances are exactly equal, that they all have the same current, and it is difficult to get both the resistance and number of turns exactly the same in all. They should be made about the same thickness as the finished magnets will probably be, in order to eliminate any difference in the mean distance from the wire to the iron. The size of the wire depends upon the machine or battery, at the disposal of the constructer, for the exciting current. If this gives a small current of high potential, use tolerably fine wire; if it gives low potential and large currents, use thick wire. In all cases, it is best to make a rough preliminary calculation, so that one is not baffled by the incapacity of the exciting machine.

In the absence of an exciting machine, the coils may be supplied from the machine which is being tested, either by running a shunt current from it into the coils, in which case an adjustable resistance is placed in circuit with the magnet coils to regulate the shunt current; or they may

be run in series with the external circuit, in which case an adjustable resistance must be placed as a shunt to the magnet coils, in order to regulate the current in them. In the first case, the armature must be credited with the current shunted off into the temporary coils, and in the second case the electromotive force of the machine must be measured at the poles of the armature and not at the poles of the machine, as there is a loss of potential in the magnets.

There is, naturally, a practical limit to the magnetization which can be generated in the given cores and pole pieces, owing to the fact that the iron becomes saturated. This limit ought, in practice, not to be exceeded, for if it is, the magnetism becomes expensive as regards the energy consumed. There are some practical values given by different authorities regarding this limit. One of them is to take 110 ampère-windings per square centimeter cross section of core, which is equal to 710 ampère-windings per square inch. This is probably for round wrought-iron cores. The writer found for a certain machine with cast-iron oval magnets, 37 ampère-windings per square centimeter, or 240 per square inch, to be about the safe and economical maximum. Of course, more than this could be taken, but it is not to be advised, for the magnetism then no longer increases in proportion to the ampère-windings. On the other hand, to use much less than this, makes the machine uselessly heavy and large.

As the magnetization varies less with a varying magnetizing current, after the point of saturation is reached, some makers prefer to use their machines over saturated, because then the current delivered by them is more constant for slight variations in the magnetizing current. In other words, the machine is less apt to change its electromotive force for slight changes in the external resistance. When this is done it is at the expense of the energy consumed by the magnets, and the point of saturation should therefore not be exceeded any more than is necessary to obtain this steadiness.

The size of the core being given, the limit of the ampère-windings can easily be determined from the above constant, and it should not be exceeded, at least not much, unless the iron is particularly good. As the economic density of the magnetism, or the saturation limit, depends so much on the iron used, it is better, in all cases where the constructer has the opportunity, to find the proper limit himself by the following method:

With the machine just as it is for the foregoing test, run it at a very low speed, for instance, belting from the shaft directly; run it on open circuit with a fixed position of the brushes at about the theoretical neutral line. Connect the brushes with a volt-meter, and excite the magnets as before with the current from another machine, beginning with a small current and increasing as high as the wire will stand, measuring in each case the exciting current and the electromotive force at the poles.

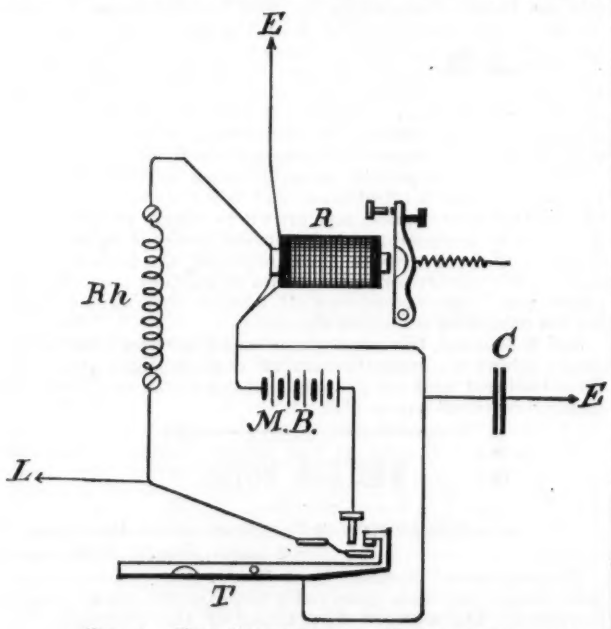


FIG. 1.—THE CONDENSER IN TELEGRAPHY.

The electromotive force on open circuit is a direct representative of the magnetization of the field, that is, the useful magnetism. The ampère-windings, that is, the exciting current multiplied by the number of windings in the coil, represent the cost of the energy to produce this magnetism. By plotting these values a curve is obtained which represents the relation between them, and which will show, up to what degree the one rises proportionally to the other. In the accompanying diagram (Fig. 1) such a curve has been plotted, the values being taken from an actual case.

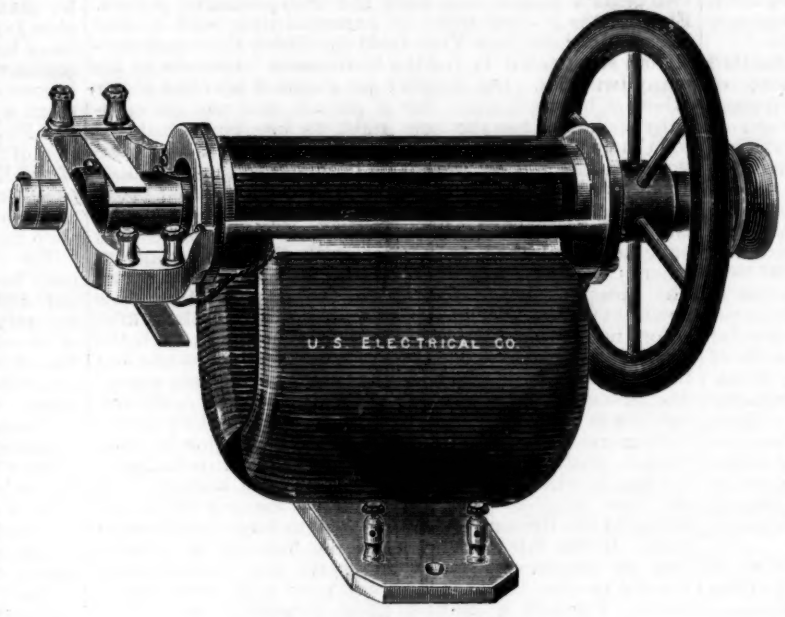
The ordinates represent the ampère-windings, and the abscissas the potential. We see from the curve *a b* that the useful magnetism, or its representative, the potential, rises proportionally with the ampère-windings up to about 27,000 ampère-windings, at the point *c*, where it takes a decidedly different direction. This point is the limit at which the useful magnetism is economically obtained, and is, therefore, the limit to which the machine should be magnetized. It is the point at which the magnets are saturated. Dividing this quantity of magnetism, or this number of ampère turns, by the area of cross section of all the magnet cores, gives the constant above referred to, that is, the maximum allowable density of the magnetism just before saturation. In this special case there were four magnets, each with a cross section of 181 square centimeters, giving, therefore, thirty-seven ampère-windings per square centimeter, or 240 per square inch.

The distance *o a* shows the remnant magnetism, while that part of the curve *c b* shows the increase of magnetism due to the coil itself, after the iron is saturated.

This diagram also shows a very important point to be noticed in building compound machines, to be referred to later.

The speed at which the machine must be run for this test depends, of course, on the range of the voltmeter at our disposal. It should be so chosen, that the values for the potential are inside of the range of the instrument, which can be determined by trial. Shunting the instrument with a high resistance, or putting a resistance in series with it, are devices which may be used to reduce the values to the range of the instrument; provided there is no appreciable current allowed to flow, as that would, by shifting the diameter of commutation, change the results.

(TO BE CONTINUED.)



A SMALL ELECTRIC MOTOR.

A Small Electric Motor.

Our illustration above represents a small motor recently brought out by the United States Electric Company, of this city, and designed for situations in which light work is required. The magnets of wrought-iron are bent in the form of a circle, and between the poles there rotates an armature of the Siemens type. The motor is very compact and, having no dead points, can be started from any position.

The Condenser in Telegraphy.

BY L. O. MC PHERSON.

The article in your issue of Dec. 19th of Mr. Benj. Thompson, descriptive of his application of the condenser to multiple telegraphy, is interesting and instructive in showing the different methods of connecting up the condenser for the purpose of eliminating the effects of the static "kick," and is well timed, considering the pending legal controversy on this matter.

Thinking that more on this subject would be of interest to your readers, I will describe a method which I patented last July. Referring to the diagram, Fig. 1, *R* is a differential relay; *R h*, equating resistance; *M B*, main battery; *T*, transmitter; *C*, condenser; *E*, earth, and *L*, the line.

It will be seen from this that the condenser receives its charge from the opposite pole of the battery from that charging the line, and consequently if given an equal capacity, will neutralize the line charge by an equal charge of an opposite polarity, each acting on the same winding of the relay at the same time.

The amount of condenser surface necessary for a given circuit depends, to a large extent, upon the resistance of the relay or relays in circuit.

In quadruplex work where there are two relays of comparatively high resistance, the amount of condenser surface for a given circuit is but slightly in excess of that necessary by the Stearns method, but unlike the Stearns method and like Mr. Thompson's my arrangement serves a double purpose when applied to quadruplex work, that is, obviating the static effect of the home battery and "filling in" the interval of "no current" at the instant of reversal by the distant station.

In connection with this latter point, I wish to describe a method of steadying the signals on the neutral side of the quadruplex which I invented and endeavored to secure patents on in October, 1882, but abandoned it, seeing no profit therein.

In the diagram, Fig. 2, *I* is a large induction coil having two primary circuits of about two hundred ohms each and a secondary of about one thousand ohms wound on in the usual manner; *L*, line; *R h*, equating resistance; *P R*, polar relay; *R*, differential coils of neutral relay; *Re*, straight wound electromagnet of about three hundred ohms, and *K S*, the wire to key service, etc.

The primaries of *I* are connected in circuit differentially so that outgoing currents are rendered neutral, but incoming currents produce magnetic and inductive effects.

As the addition or removal of the "long end" of the distant battery produces but a small disturbance of the line charge, compared to the disturbance created by a complete reversal of the entire battery, the induced currents set up in the secondary of *I* by the former are proportionately small and need not be taken into consideration, but those developed by the latter cause are of considerable strength and sufficient to energize the magnet *Re* perceptibly.

I attach the local circuit (extra) to the back-stop *B* and armature of *Re*. The tension of spring *Sp* is light, only sufficient to cause the armature of *Re* to follow the armature of *R* in its forward motion, moving backward by the heavier tension of *S*.

When a signal is arriving upon *R*, should a reversal of the current take place by operation of the pole-changer at the distant station, the induced current developed in the secondary of *I* energizes *Re* sufficiently to prevent the giving of a false signal by the armature of *R* falling back.

In another improvement in this direction, I dispense with the coil *I* and make the magnets of the polar relay of two smaller inductions coils, and in the neutral relay the magnet *Re* is mounted upon the opposite side from *R*, but below the centre, so that its attractive force, when exerted, acts in the same direction upon the armature as *R*.

I have worked this latter arrangement in practical use and find it does very nicely, but it makes the polar relay somewhat cumbersome in appearance although its working qualities are not impaired.

I believe properly constructed instruments on this plan will greatly improve the working of long quadruplex circuits.

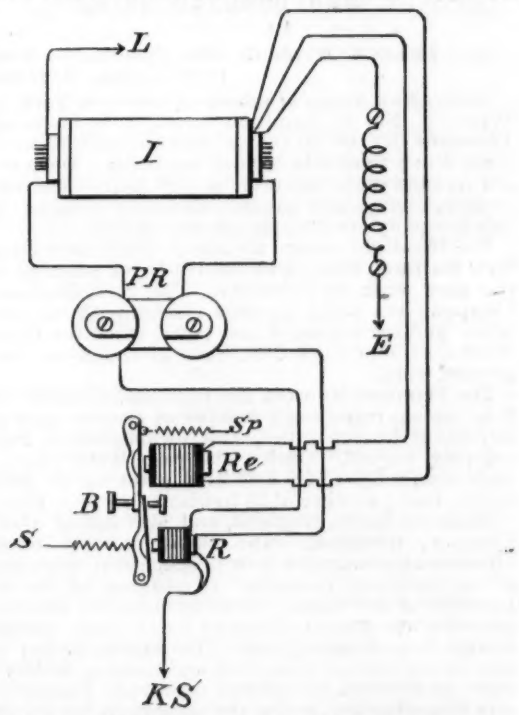


FIG. 2.—THE CONDENSER IN TELEGRAPHY.

Mr. Stokes Objectionable.

William Burry, attorney for some dissatisfied stockholders in the Board of Trade Telegraph Company, appeared before Judge Moran in Chicago, on Jan. 11, and asked for an injunction preventing Edward Stokes, of New York, from exercising his franchise in the annual election of officers, and in transacting other business which will come before the board at their regular meeting. The Board of Trade Telegraph Company gave a lease to the Bankers & Merchants' Company, and when the latter defaulted to a heavy amount a receiver who was appointed issued certificates, of which Mr. Stokes bought a large amount at a very low figure. Subsequently, with these certificates, he purchased 387 shares of stock in the Board of Trade Telegraph Company, which gave him a controlling voice in the deliberations of the company. A suit is now pending in New York to set aside the sale of stock to Stokes, and at the annual election of directors the members wanted Stokes enjoined from having a voice in the matter until after a decision of the New York court settles the question of his ownership of the stock. Judge Moran instructed the company to defer their election until some time next week, and in the mean time he can hear the case fully.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
Jan. 11, 1886.

Inch by inch the electric light is making its foothold broader, and it has now gained the perfect confidence of all who have tried it. Until lately, there has been a tendency to put in "combination fixtures," but the idea now becoming predominant is that the electric light alone is sufficient. The new Phyfe & Campbell building on Fifth avenue and 58th and 59th streets, this city, has been wired for electric lighting, and is, if I am not mistaken, the first of the kind in the city without an inch of gas pipe in it. I learn, too, that in other new buildings the same plan is to be adopted. Some electric light men may see nothing very extraordinary in this, but their belief in the new illuminant has not been shared by everybody, and such an action marks an immense stride in the right direction in securing public trust and good will.

Mr. H. P. Hungerford, of the Electrical Supply Company, 17 Dey street, reports business good. The Ansonia factory has recently been enlarged and refitted with new and improved machinery, and the company are now in a position to supply all kinds of wire for electrical purposes of superior quality and finish, as well as their well-known specialties. Mr. Hungerford has settled down in his new quarters very comfortably.

Mr. George F. Shaver, President of the Consolidated Telephone Company, furnishing the Shaver system of acoustic telephones described in THE ELECTRICAL WORLD of Dec. 26, admits frankly that he is himself surprised at the recent rapid growth of the business, especially since attention was thus called to the subject. He has a remarkable testimonial from Mr. J. W. Lattig, well known to many as the Superintendent of Telegraphs of the Lehigh Valley Railroad. Mr. Lattig states that he now has twelve Shaver instruments in use along the road, and adds: "The longest line we have yet tried is 1,800 feet, with a number of angles, some of which are quite sharp. The oldest line was erected in June last, and has never been in trouble since. These lines are used in the regular run of business, hence car numbers, weights, amounts of money and messages of all descriptions are daily transmitted and received over them, irrespective of moving trains, blowing whistles, running machinery, etc." There is more to the same effect, but as Mr. Shaver has not yet obtained permission to use the letter as a whole, I refrain. Mr. Shaver told me, however, that the firm of Klotz & Lattig has been formed, with headquarters at Mauch Chunk, to place the instruments in six Central Pennsylvania counties.

An Amet electric steam engine governor was shown to me this week at the offices of the New York Electric Construction and Supply Company, 145 Broadway. The current from a dynamo energizing a large magnet raises and lowers a lever which in turn acts upon two friction wheels running in opposite directions, and thus the steam pressure is controlled in the valve chest and cylinder.

Dennison's Automatic Electric Messenger system is exhibited at the new office of the company, 47 Broadway.

Albon P. Man, the electric light inventor, who was interested with Sawyer in bringing out a well-known incandescent lamp and other important inventions, will, I hear, soon introduce several striking novelties in the same line. W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Jan. 11, 1886.

At the New England offices of the New York Insulated Wire Co., No. 33 Hamilton street, it is reported by the Treasurer, Mr. W. B. Dowse, that the business of the company is in a most satisfactory condition. During the past six months there has been a very heavy demand for the insulated wires and cables (Grimshaw process) of which this company are the sole manufacturers.

The 1600-light central station of the Edison Company at New Bedford, Mass., will be ready for starting up about the first week in February. The New England Wiring Company has fitted up this station with all the inside wires and the wiring of the poles, while the Edison Tube Works, of New York City, have attended to the underground work.

The Thomson-Houston International Electric Company is at present installing a number of electric light plants in important foreign cities, and its business is rapidly developing abroad. During the past thirty days, orders have been received for a 45-light plant to be installed in Milan, Italy; another of 25 lights at Palermo, Italy; one of 25 lights at Leeds, England, and also one of 15 lights at Glasgow, Scotland. The plant recently installed at Hernosand, Sweden, is now in successful operation, and is giving satisfactory results. In addition to the arc lights installed at St. Johns, Newfoundland, by this company, an order was recently received for the early installation of a large incandescent plant. The officers of the company also report several other very encouraging orders for arc light plants from far distant countries, among which is one from Bombay, India, the equipment for which will be shipped in a few days.

The Consolidated Electric Light Company, Portland, Maine, has ordered three Armington & Sims engines from the Jarvis Engineering Co., making six in number of this style engine used by the first named company.

The signal service station in this city is said to be the only one in the country at which electric lights are used for the signals. Whenever it is necessary to display storm signals at night, the lanterns are lighted by electric lights, which make them remarkably brilliant.

The Ball Electric Light Company are installing a 25 arc light plant in the Riverside & Oswego Mills, Providence, R. I.

A Lowell, Mass., dispatch to-day states that "the suit of James W. Bennet, Alexander W. Sherman and Henry L. Tibbetts, of Lowell, against the Lowell telephone syndicate, brought last May to recover $110,000 for alleged misrepresentations leading to the sale of telephone stock, has been submitted to Col. John H. George, of Concord; Wm. D. Caldwell, of Nashua, and Hon. Charles H. Allen, of Boston, as arbitrators."

Mr. Gardiner C. Sims, of the Armington & Sims Engine Company, Providence, was in Boston for a few days last week. He reports an increasing demand for his company's engines for electric lighting stations and plants. A branch office has been established in Chicago, in the Home Insurance Building, No. 201 La Salle street, Mr. Fred H. Hayward, agent.

Under heading of cheap electricity the Boston *Daily Globe*, of January 9th issue, contained the following: "Theodore L. Kauffer, inventor, of Boston, was a very lucky man. He succeeded in beating a score or so of brother inventors in the race for a patent, and secured from the United States government rights which for broad and sweeping generalization have seldom been excelled. This good luck of his is going to be of immense importance to everybody in America who uses a galvanic battery. To understand the importance of the patents of Kauffer you must first recall the nature of a galvanic or voltaic battery. In brief, it may be said that such a battery consists of a vessel containing two metals, which are acted upon by some chemical, this action producing an electric current. For a long time the chemical most commonly used has been bichromate of potash, because the chromic acid produced has been one of the cheapest and at the same time most powerful depolarizers (electricity makers) (*sic!*) obtainable. It has been known for some time that bichromate of soda could be substituted for bichromate of potash, but the cost of the bichromate of soda rendered its common use out of the question. A year or so ago a new way of making it was discovered, a way so cheap that now it costs two cents a pound less than the bichromate of potash. Electricians at once went to experimenting with it, and last summer the New York Gold and Stock Exchange electrician substituted it for the bichromate of potash in his many batteries. But Kauffer got ahead of him and many others in his application for a patent, and now the company spoken of has the sole right to use bichromate of soda in galvanic batteries. Not only does the new solution cost less, but because of its immense solubility it lasts about five times as long; moreover, from a peculiar property it has, it does not clog up the battery as the other bichromate does. It is claimed that the metal plates will have to be cleaned only once with the new solution, where they had to be cleaned three times with the old. The most important feature of the new solution is its power to supply electricity so much cheaper than ever before by chemical means. It cannot compete with the dynamo, which gives electricity by mechanical means, but the dynamo can be economically used only where a good deal of electricity is wanted. Take, for instance, electric lighting in residences some distance from a city. Few householders can afford a dynamo to run electric lights in their houses. Hitherto no battery has been able to run the lights for any length of time. It is claimed that a battery with the new solution will run the lights for over 200 hours. Hitherto the running power has seldom been over twenty-four. It was this fact that made the lighting of railway cars by primary batteries so costly and troublesome. Electro-motors, too, it is said, will now gain new importance. For half a century these machines have been promising wonders, and inventor after inventor has expected with them to revolutionize the world. The trouble with them all has been that they couldn't get the electricity, the motive power, cheap enough. It is improbable that electricity generated by chemical means will ever be had cheap enough to pay for the running of much machinery and surely it can never compete with the dynamo for heavy work, but in the running of sewing machines, lathes, small saws, etc., there is plenty of room for electro-motors operated by primary batteries. Electricians will be interested in these measurements, taken after six hours' work on a closed circuit by the new solution, Volta pavia it is called; electromotive force, 1.6 volts; intensity of current, 5½ ampères; internal resistance, 7-100 ohms. An electric light operated by it can be seen in the elevator at No. 95 Milk street."

The Peruvian Electrical, Construction and Supply Company is an enterprise doing business under the auspices of the Thomson-Houston Electric Company, with offices at 131 Devonshire street, this city. The company is in receipt of advices from Peru that the plant, consisting of 90 Thomson-Houston arc lights, recently installed at Lima, is in successful operation, and that a deep interest has been evinced by capitalists of other sections of that country with a view to the installation of the same system of electric lighting in their respective towns.

Messrs. Paine & Francis, New England agents of the Edison Company for Isolated Lighting, have removed into larger and more commodious offices, up two flights in the *Herald* Building, this city. The firm will hereafter occupy rooms No. 13 and 14 on the third floor. W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
PHILADELPHIA, Jan. 11, 1886.

The Philadelphia Sectional Underground Company, which has a substantial iron conduit under Chestnut street, from Third street to Broad, is making a strong effort to induce the Western Union to use its plant instead of laying down one of its own. The "Sectional" company's conduit has been working successfully for over two years, inclosing electric light, telegraph and telephone wires. It has a capacity of 3,000 wires, and the route would carry the wires from Third and Chestnut streets direct to the Western Union's new main office at Broad street. The latter company will not, however, listen to these overtures, and will construct its own system in the spring.

It is now said that the Sectional Underground system has been sold out to a syndicate representing the Standard Oil Company. Rumor says that this is a vast underground scheme and that the capitalists who are behind it propose to extend the system so as to furnish light and power throughout the entire city. The reason given for connecting the name of the Standard Oil Company with this ambitious scheme is that that company intends to use the conduits also for supplying fuel gas to consumers, thus furnishing them with heat, light and power.

There was a good deal of talk on the part of the authorities of forcing the wires underground, and it now looks as if the wire people had banded together to give the citizens more "underground" than they anticipated. President Green, of the Western Union, has just applied for permission to tear up Sansom and other streets, and an ordinance has just been introduced in City Councils permitting Henry Clay, the electrician, and George W. Bratton to lay pneumatic tubes for the transmission of dispatches and small packages. This scheme proposes to lay down a network of tubes all over the city. Councils have also just granted permission to the Associated Press to open the streets and lay pneumatic tubes between the various newspaper offices. Here, then, are plans to tear up the whole town, and the underground advocates are beginning to fear that they may get rather too much of their own plans.

The telegraph people have opened a war on the "bucket-shops" and will give them no more quotations. The recent influx of "bucket-shop" brokers to this city was due to the lowering of the price of ticker service from $25 to $5, which was brought about by a fight between the Philadelphia Local and the Bankers & Merchants' Telegraph companies. It is said that this reduction was due to the organization of a stock-reporting branch of the Bankers & Merchants' by the brokers of the Stock Board, and the consequent competition of the two companies in the stock-reporting business. It is contended that one of the first steps taken by the Bankers & Merchants' was to lower the bucket-shop prices to those charged upon the regular brokers. This also forced the Philadelphia Local down, and, with investments to be had for a mere song, as compared with what had been paid for them, bucket-shop brokers flocked over here from New York in great numbers, and clustered about the Stock Exchange, to the disgust and financial injury of the regular stock offices. It happened, however, that the Philadelphia Local had instruments which suited the wants of the bucket-shop customers better than the Commercial instrument, and so the Philadelphia Local got nearly all the business. It is claimed that there has always been a bitter feeling between the representatives of the rival Philadelphia Local and Commercial instruments, and that the real object of the present movement was to provoke a fight between the Stock Exchange and Philadelphia Local, which would result in the ejection of the latter's gold and stock business from the floor of the Exchange. The Philadelphia Local, however, prepared to obey the wishes of the Stock Board, and so issued the order withdrawing its instruments from the bucket-shop rooms.

The Fidelity Insurance, Trust and Safe Deposit Company has purchased property in Franklin Place above Chestnut, and will locate an electric light plant there. It will not only supply its own building, but furnish light to such of its neighbors as the extra amount of power will warrant. The object of renting out the light will only be to reduce the cost of the same to the company and to pay for the plant.

Charters have been issued to "The Washington Electric Company," of Pittsburgh, with a capital of $1,000,000, and "The Citizens' Electric Light Company," of Coatesville, Pa., with a capital of $15,000.

It is said that General Huidekoper, who was recently superseded as Postmaster here, has accepted the presidency of a telephone company in New York City at a salary of $10,000 per annum.

The Chief of Police last week received letters from New Zealand and New South Wales, inquiring about "The Norman Electric Light Company of Philadelphia," which has been advertising extensively in Sydney and other parts of Australia. This "company" was exposed as a fraud some time ago, and is believed to be one of the schemes of Emil, *alias* Marsh, Bassett, who is now awaiting trial here on a charge of fraud.

The complete portable apparatus for measuring electrical currents, manufactured by Queen & Co., of this city, is receiving high encomiums. It is composed of a Wheatstone bridge with divided scales, a set of fixed resistances and a galvanometer, all combined on a neat base. The coils are so arranged that resistances from 0.1 ohm to 1,000 ohms can be measured, and they are guaranteed to an accuracy of 1 per cent. The apparatus was designed to fill the need of a good instrument for practical men and students at a low price.

The Cleverly Electrical Works have had a very successful year's business. They are the manufacturers of electric gas lighting apparatuses, and have increased their facilities and enter the field, with the new year, as manufacturers of electric lights. They propose taking contracts for the establishing of complete plants, and persons contemplating the putting in of a plant will do well to communicate with them. As Mr. Cleverly is a thorough electrician, and surrounded by competent and experienced men, their work cannot but give satisfaction.

The boiler compound manufactured by Geo. W. Lord has gained quite a reputation, and what was a small business a few years since has grown to large proportions. Mr. Lord is in receipt of large orders from all parts of the world, and those who use the compound are sure to order more. His advertisement appears in another part of your paper, and I can recommend all keepers of boilers to send for his pamphlet on boiler cleansing.

Gill & Murray, the large glass manufacturers, have recently added the manufacture of electric light globes to their business, and are prepared at all times to fill orders in large or small quantities. E. F. I.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, Jan. 9, 1886.

The engines of the New York Safety Steam Power Company have long been deservedly popular for electric light purposes. The western department of the company, located at Chicago, did a very large business in December, selling no fewer than twenty-three engines. Mr. W. A. Hammett, the Western manager of the company, reports the prospects for this month as equally good.

The Van Depoele Company are vigorously pushing matters in their electrical railway department; they have just contracted to furnish Montgomery, Ala., with an electric railway system. There has also been organized a local electric railway company, whose purpose is to get a railway equipped with the Van Depoele apparatus in Chicago.

Recent orders of the United States Electric Lighting Company include the following: Lima, Ohio, paper mill 100 incandescent; Jackson, Mich., 160 incandescent; Charles G. Stifels Brewing Company, St. Louis, 300 incandescent; University of Illinois, 60 incandescent lights.

Oppermann Bros. have lately sold three incandescent light plants to be placed in Chicago, one of which is to go into the establishment of N. K. Fairbanks & Co.

The Pond Engineering Company, of St. Louis, Mo., begin the new year with orders for steam plants for electric light stations at Des Moines and Davenport, Iowa, and Greeley, Col.

The Kriebel steam engine, which was illustrated some time ago, is assuming some prominence as a desirable engine for use in connection with small electric light plants.

These engines range from one to ten horse-power, and are very compact and exceedingly simple. The price, too, is very reasonable. The manufacturers, Rice, Whitacre & Co., 42 and 44 W. Monroe street, Chicago, will be glad to send their catalogue to any one writing for it.

Mr. Foley, the new manager of the Sperry Electric Light Company, will, contrary to his former intention, make his headquarters at Chicago.

The Ball Electric Light Company have recently installed an electric light outfit in Burke's European Hotel, Chicago.

Some of the stockholders of the Inter-State Telephone Company have been making some pretty advantageous sales of the stock of that company, if current reports are to be believed. It is said that some two hundred shares of this stock have been sold to one party at par, for which proceeding he now asks relief from the Court, claiming to have been deceived as to the real value of the shares.

The Okonite Company, of New York, are furnishing a very large quantity of wire to the Western Union Telegraph Company just at present for use in Chicago. W. A. K.

THE TELEGRAPH.

Wires Down.—The heavy storms of the last week have been followed by reports of wires down in all parts of the country. Repairs have been effected with the usual promptitude.

Signaling Exercise.—The Chief Signal Officer has directed that a signal line be run from Washington to Point of Rocks, in order to exercise the graduating class at Fort Myer in field signaling.

A Bad Accident.—Two trains collided near Wilmington, Del., in a snow-storm, on Jan. 9, when George W. Brinton, a signal tower operator, was among the killed, while James Melvin, train dispatcher, suffered a compound fracture of the right leg and received internal injuries.

A Big Mortgage.—A heavy mortgage has been filed for record in the Macon County Recorder's office, Illinois. It is filed by the United Lines Telegraph Company, of which Edward S. Stokes is President, which company will operate telegraph lines through that part of the State. The mortgage is for $1,200,000 in favor of the Farmers' Loan and Trust Company, of New York City, and is to draw interest in gold at the rate of 6 per cent. per annum until 1905.

Another Postal Bill.—The Postal Telegraph bill introduced by Senator Dawes on Jan. 8 comprises substantially the first ten sections of the bill reported by Senator Hill from the Committee on Post-Offices and Post Roads during the last Congress. It provides for the establishment of telegraph offices in all post-offices and for the transmission of telegrams by contract with existing lines. Rates are fixed at 25 cents for five hundred miles, and five cents additional for every additional 250 miles for twenty-word messages, provided that no rate shall exceed 75 cents. The provisions of the Hill bill for the purchase of existing lines or the construction of new ones are stricken out.

Wires Down in the West.—The telegraph officials state that the recent storm was more destructive in Iowa than any they have known in many years. A sleet storm swept down poles and wires from Northern Iowa to Southern Kansas, and before the lines could be restored the fierce storm of last week completed the work of destruction. For a time very few lines were available at all in Iowa, but the situation has since begun to improve somewhat. The cold has been so intense in addition that it makes the work of repairing very difficult. Four engines were sent out from Omaha on Jan. 9 with gangs of repairing linemen, and the service west of Omaha is showing some signs of improvement.

The Atlantic Telegraph Company in Massachusetts.—Some curiosity having been aroused by the incorporation in Massachusetts of "The Atlantic Telegraph Company," with Parker C. Chandler as President, and Charles G. Winter, Secretary, it has been explained that this was merely an incorporation under Massachusetts laws of the Atlantic Telegraph Company, already incorporated in Maine, which is the ally of the Baltimore & Ohio road east of Boston. The object was to secure the better protection which Massachusetts laws give home telegraph companies. For instance, the Western Union exists there only in name. The Baltimore & Ohio, too, has an especial Massachusetts incorporation. Home companies are given certain rights which foreign companies have not.

No More Telegraph Franks.—Mr. Anderson's bill before the House of Representatives, to prohibit members of Congress and judicial officers from receiving railroad passes or telegraph franks, provides that before any installment of salary falling due to any of these officers shall be paid to him, he shall certify in writing that during the period for which such installment is due he has not traveled on any railroad nor transmitted any message by telegraph at rates less than are paid therefor by the general public for like services, and in the event of his failure to make such statement, the installment of salary shall be forfeited and remain forever unpaid. A fine of $1,000 is imposed upon any officer of a railroad or telegraph company furnishing passes to any of the persons mentioned. Mr. Voorhees, of Washington Territory, also introduced a bill to punish with a fine of not less than $500, nor more than $5,000, any officer of a railroad or telegraph company who issues free passes to any employé of the United States, including the President, Vice-President, Cabinet officers, Senators, Representatives and judges.

Putting New Fire-Alarm Boxes in Order.—When the Western Union Telegraph Company laid underground conduits in Dey street, Broadway, Twenty-third street and Fifth avenue, it was stipulated that two wires were to be for the use of the Fire Department. Superintendent Smith, of the Fire Alarm Telegraph Bureau, has had the underground wires connected with signal boxes along the line of the conduits. The wires make two continuous circuits of the fire-alarm system, nearly six miles in length. Lamp-posts, of a new and ornamental design, support the signal boxes. The new boxes are of the keyless pattern. They can be opened by turning a handle, which also rings an alarm bell. Above the red box in each post is a lamp which is expected to be lighted and to have a red glass. Superintendent Smith has placed six of the new signal boxes in working order, and finds that calls from them go to Fire Headquarters correctly. The boxes will be used in case of alarms hereafter. Four of them are in Broadway at Thomas, White, Grand and Prince streets, one is at Houston and Mercer streets, and one at Fifth avenue and Eighteenth street.

THE TELEPHONE.

Eccard and Drawbaugh.—In the contest in the Patent Office between Eccard and Drawbaugh, to determine the question of priority of invention of a certain form of telephone in use in the Signal office, the examiner has decided Drawbaugh to be the prior inventor.

A Telephonic Opera Saloon.—It is said that arrangements are about to be made for "laying on" the telephone to the Covent Garden Opera-House, London, and opening a telephonic saloon, where, by the payment of a shilling, persons may look in and hear a portion of the opera.

Facilities in France.—Rouen and Havre having been placed in successful telephonic communication, it is contemplated to give the benefit of a similar connection to Paris and Rouen. Meanwhile the engineers of the French service are establishing a telephonic line between Paris and Rheims.

Four Per Cent. Guaranteed.—It is reported in Lowell that at the next meeting of the directors of the New England Telephone Company, in Boston, a proposition will be received from the American Bell Company, making certain concessions. This, it is said, will make the New England a guaranteed 4 per cent. stock.

Plainfield, N. J.—A special dispatch of Jan. 10 from the above place says: There is a lively war going on between the city and the New York & New Jersey Telephone Company. A charter was granted the telephone company by the city on condition that they should place a telephone in each of the fire engine houses and in the hook and ladder and the Alert Hose Company's houses. The company accepted the condition, and for a year faithfully carried out its contract. Some time ago, however, its officers removed the instruments from the hook and ladder and hose company's houses, and when the city demanded they should be replaced, refused to comply with the request and told the city that they could not be compelled to replace them. Immediate action was taken in the matter, and the telephone officials were ordered to place no more wires in the streets. They have paid no attention to the order, and now the city threatens to take away their franchise or else compel them to remove the poles they have erected and place their wires underground. It is claimed that the company makes from $3,000 to $4,000 each year over all expenses out of the franchise, and that it can well afford to place telephones in the places agreed upon.

THE ELECTRIC LIGHT.

Houlton, Me., is to use 90 arc lights, the dynamo to be run by steam instead of water, as was at first intended.

In a Nail Factory.—The Tremont Nail Company, Wareham, Mass., has put in a plant which furnishes light for the factory, office, store and hall.

Improving a Mill.—The introduction of electric lights is one of the many improvements made by the enterprising firm of Hammond & Knowlton in their new silk mill, Putnam, Conn.

The American System.—The new factory of the American Company, New York City, is now in full swing, and has begun shipments of plant. It has a capacity of about 200 arc lamps per week.

Pushing Things.—The Woburn Electric Light Company, which began lighting the places of business last July, had on the first of this month over 800 lamps burning, with orders ahead to fill.

Electric Lighting.—Colonel Haywood, the City of London electrical engineer, deprecates the proposal of the Commissioners of Sewers to undertake to supply electricity, and advocates the repeal of the Electric Lighting Act, to which he attributes the existing stagnation of electrical enterprise in England.

Helping the Match Trade.—"Do electric lights lessen our trade?" echoed a maker of matches to an interviewer's question. "Oh, dear, no. You must have seen frequently smokers trying, absent-mindedly, to light their cigars or cigarettes at the electric light, and of course they can't do it. If it had been a gas jet, they would have had no trouble. The electric light forces them to use matches which they would not have used otherwise. It takes only one match to light a gas jet, at which perhaps a dozen cigars wil be lighted later on."

APPLICATIONS OF POWER.

To Manufacture Motors.—Recognizing the importance of electricity as a power for locomotion, the celebrated Rhode Island Locomotive Works, Providence, R. I., have equipped themselves for the manufacture of electrical motors, and are now engaged on a motor which will very soon be completed, and a practical test of its capabilities will be made on a track that is about to be laid for the purpose at the premises of the works. The motor, it may be stated, belongs to the Bentley-Knight system, which has already been tried elsewhere with success.

"Electro Motors" was the subject of a paper read recently before the Engineering Society of London by Mr. A. Snell. After laying before his hearers the theory of electro motors the author described minutely the Immisch motor, assigning a reason for cutting away a portion of the poles of the field magnet, in the fact that to secure the highest efficiency in the motor the weight of the field magnets must nearly or quite equal that of the armature. In a reversible motor the poles are cut away on each side, leaving only a point presented to the armature. The efficiency is thus lessened but 1.5 per cent. He also demonstrated that the Immisch motor possesses the advantage of being practically sparkless when run with a normal load. The efficiency of a three horse-power motor of this type was stated to be about 80 per cent.

PERSONAL.

Commander Hoff and Lieutenants Meigs and Reeder, of the U. S. Navy, have been appointed a board to proceed to Baltimore to examine the electrical apparatus recently invented for distinguishing sounds at long distances, with a view to its adoption in the naval service.

MISCELLANEOUS NOTES.

Hell Gate.—Mr. Johnson, of New York, has introduced a bill in the House of Representatives to appropriate $12,000 for the purchase of the site of the Hell Gate channel electric light, near this city, on the East River.

"Industrial America."—The issue of this paper for January 16 contains twenty-one fine illustrations. The leading articles with cuts are: "The English Mint," "New Tenoning Machine," "Heavy Universal Milling Machine," "The Rapid Transit Problem in New York," "The Niagara Direct Acting Steam Pump," "A New Torpedo Boat," "Library Extension Lamp." There are besides twenty articles of a very interesting nature, industrial correspondence, editorial notes, and a number of departments. Sixteen pages every other week. Ten cents a number, $2 a year.

"Johnston's Journal."—The Jan. 9 issue of this popular semi-monthly magazine contains a great many interesting articles, among which may be named: Utah and Its People, with four illustrations; An Amateur Photographer at the London "Zoo," with five illustrations; Pasteur and His Work, with portrait; New Year Scenes in Washington, with full page of sketches; and the first of a series of articles on celebrated anonymous poems, with a fac-simile of "Compensation." The magazine also contains the first installment of a new serial story; a complete story, "New Year Resolves;" three illustrated book reviews; a comic sketch; several short miscellaneous articles, and a number of interesting departments. The price of this handsome, 36-page magazine is only 10 cents a copy, or $2 a year.

SPARKS AND FLASHES.

Seeing Double.—Bell, the electrician, expects to see an arrangement perfected by which people can see by electricity. Bell is behind the times. It was discovered long ago that Jersey lightning enables a fellow to see double.—*Richmond Dispatch.*

An Electric Mouse Trap.—With Jay Gould off for a winter vacation the mice in Wall street will think they can have a play spell, too. But they had better be wary. The Gould species of cat knows how to catch mice by telegraph.—*Boston Herald.*

Weedy, if Not Fishy.—During a sermon which he delivered recently at his church in London, Dr. Thain Davidson, the well-known Presbyterian divine, said: "I am told that the submarine telegraph cable in Bass' Straits, weighing ten tons a mile, was actually floated to the surface by sea-weed which attached itself to it." We would like to see a specimen of that sea-weed.

Dropsy?—"Mr. Fangle, I saw in the paper that the growth of the telephone is one of the most remarkable in the history of inventions," remarked Mrs. F.

"So it is, my dear."

"Well, I don't think it is."

"No? Why?"

"Well, we've had our telephone in over two years and it hasn't grown an inch."

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—Am. Dist., a 31; B. & M., b 2, a 3; Western Union, b 74⅛, a 74⅜.

Telephone.—Am. Bell, b 170, a 171; Erie, a 32¼; New England, a 34.

A Washington dispatch to Messrs. Irving A. Evans & Co., Boston, says: "Decision in Bell Telephone case will be announced as soon as Secretary Lamar returns to the city, perhaps to-morrow or Monday. There is no doubt that it will authorize a suit to be brought to test the Bell patents."

Electric Light.—No new quotations.

BUSINESS NOTICES.

[Copy.]

W. H. GESNER, SUP'T.

OFFICE OF
THE BRUSH ELECTRIC LIGHT AND POWER CO.,
MONTGOMERY, Ala., Nov. 17, 1885.

Messrs. Giles, Bro. & Co., State and Washington Streets, Chicago, Ill.

DEAR SIRS: I have to acknowledge receipt of my watch with magnetic shield. Please accept my thanks.

I have given the watch a thorough test—held it all about the field magnets of a No. 8 Brush machine, running at 750 rev. per minute and supplying 52 arc lamps, without visible effect.

I consider your magnetic shield a perfect protection from magnetism.

I have ruined three or four watches heretofore, and have spent money enough for repairs to buy a dozen shields almost. Very truly yours,

W. H. GESNER, Sup't.

Business Brisk.—The Jewell Belting Company, Hartford, reports an improvement in its business, and is increasing its working force to some extent.

Engines in Demand.—The Westinghouse Machine Company, of Pittsburgh, has within the last month shipped for electric lighting alone the following Westinghouse engines: Brush Electric Light Company, of Buffalo, three of 60 horse-power each, making the fifteenth order from that company; Toledo Electric Light Company, 65 horse-power; Cleveland Electric Light Company, a fifth order for 60 horse-power; Oshkosh Gas Company, for electric lighting, 50 horse-power; W. D. St. Clair, Chicago, one 50 and one 35 horse-power; George D. Sheibly, Fostoria, Ohio, 35 horse-power; the Pittsburgh Club, 35 horse-power, with a complete incandescent plant, besides about twenty smaller engines to private parties.

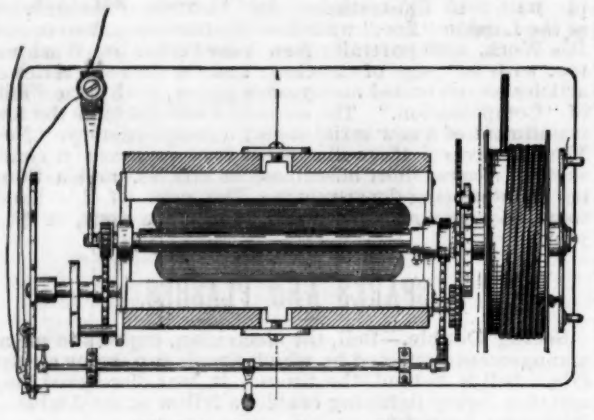
Hill's Hair and Whisker Dye
Colors to any natural shade of black or brown; 50c.
PIKE'S TOOTHACHE DROPS will cure in one minute; 25c.
DEAN'S RHEUMATIC PILLS are a prompt, sure cure; 50c.
HALE'S HONEY, the great cough cure; 25c., 50c. and $1.
GLENN'S SULPHUR SOAP heals and beautifies the skin; 25c.
GERMAN CORN REMOVER kills corns and bunions; 25c.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED DECEMBER 29, 1885.

333,110 and 333,111. Electrical Conductor; Edward Clark, Newburg, N. Y. In the first he applies emery, and in the second corundum as the base of the insulating substance.

333,131. Fire Alarm Signal; William J. Keenan, Boston, and Eugene M. Wilson, Worcester, Mass. Consists, as shown in the cut of the combination with a magneto-electric generator, a circuit wheel arranged to transmit electrical impulses in a definite order, and a mechanically impelled motor operating both the generator and circuit

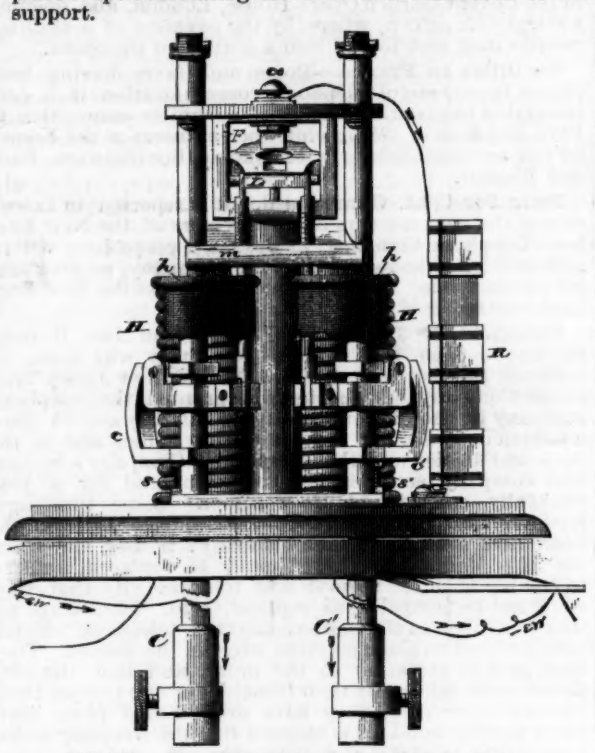


333,131. FIRE-ALARM SIGNAL.

wheel, of a shaft carrying both locking and starting levers for said motor, adapted to operate both levers simultaneously.

333,174. Dynamo Armature; Sir William Thomson, Glasgow, Scotland. Consists, as shown in the cut, in a machine having an armature composed of a wooden disc with radial projections from its periphery, and a conductor wound in a zigzag manner in and out of the corrugations formed by the said projections.

333,178. Railway Telegraph; William Vogel, Chicago, Ill., Assignor to Adolph Zeller, of same place. Consists, first, of a receiving chamber which is placed therein and supported upon springs; second, in the combination of a car, a chamber placed therein and suspended upon springs, with brackets which prevent the lower end of the chamber from moving about; third, of the car, a chamber suspended therein upon springs, and suitable electrically-operated mechanisms in the chamber, with the connecting-wires, a conducting-connection which is applied to the under side of the car, a support which extends along the main track, and upon which the conducting-connection travels, and a conducting-wire placed upon insulating material and connected to the support.



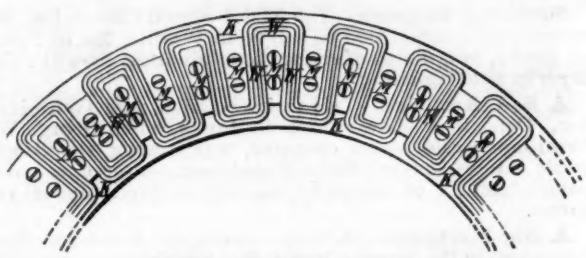
333,194. ELECTRIC ARC-LAMP REGULATOR.

333,194. Electric Arc-Lamp Regulator; Jacob Cain, Fort Wayne, Ind., Assignor to the Fort Wayne Electric Light Co., of same place. As shown in the cut it consists of the helices *H H* and *h h*, the magnets *M* and *m*, the lever *L*, the frame *F*, the carbon rods *C* and *C'*, the clutches *c* and *c'*, the set-screws *s* and *s'*, the cut-out contacts *c o* and *s p*, and the resistance *R*.

333,219. Incandescent Electric Lamp; August Harding, Oakland, Cal. Comprises an air-tight chamber, so located that the pressure of air holds the lamp globe to its stopper, the same being adapted to be removed.

333,289, 333,290 and 333,291. Telegraphy; Thomas A. Edison, Menlo Park, New Jersey. He claims the combination, with two or more sets of Morse telegraph instruments, consisting each of an ordinary relay and a signaling key, a source of electrical energy for operating the same, and shunt circuits to keep the line constantly closed at the signaling keys, of two or more other sets of telegraph instruments, each composed of a Morse signal transmitter having a separate source of electrical energy and throwing momentary and sharply-defined impulses upon the line, and a diaphragm resounder responding to such momentary impulses, whereby two sets of Morse signals can be transmitted and received simultaneously without interference. The several inventions have claims founded substantially upon the application of the principles intimated in the above claim.

333,292. Voltaic Battery; Desmond Fitzgerald, Thomas J. Jones, Assignors to the Primary Battery Co. (Limited), London, England. Consists of a water-proof layer containing peroxide of lead interposed between a con-



333,174. DYNAMO ARMATURE.

ductive support and the depolarizing agent, and being in contact on the one hand with the said support and on the other hand with the depolarizing agent.

333,298. Printing Telegraph; Clarence L. Healy, Brooklyn, Assignor to Stephen D. Field, Yonkers, N. Y. Consists in a mechanical lock, which is connected with the circuit-closing key of a press-circuit, and is arranged to lock or hold the circuit closed when the key is released, and an electro-magnet connected with the press-circuit and operating to open or disconnect said lock, and thereby break the circuit.

333,394. Electrical Conductor; Edward Clarke, Newburg, and Theron A. Richards, Brooklyn, N. Y. Consists of an electrical conductor covered or coated with an insulating material consisting, essentially, of alumina or oxide of aluminium in as pure a state as possible.

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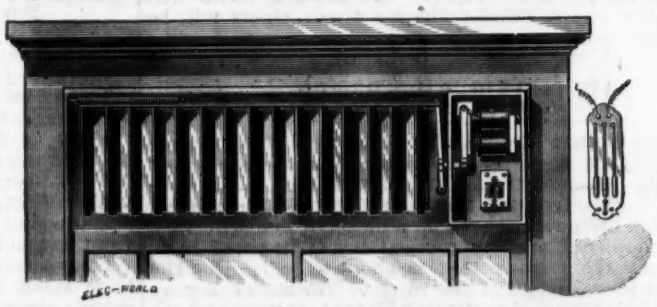

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